THE USE OF WOODLAND IN ARGYLLSHIRE AND PERTHSHIRE BETWEEN 1650 AND 1850

by

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SUMMARY

Palynological, archaeological, and ecological evidence indicates that certain established explanations of the decline of woodland in the Scottish Highlands are chronologically erroneous. It is further apparent that these explanations may be incorrect in their allocation of significance to different possible causal factors, and particularly the attribution of a major destructive role to commercial exploitation between the seventeenth and the nineteenth century.

The use of woodland in Argyllshire and Perthshire between 1650 and 1850 is examined. Study of factors associated with the non-commercial use of timber and woodland produce by the rural community, and the use of woodland for grazing and other purposes, indicates that the role of these factors was significant but largely unquantifiable.

Factors relating to commercial activity are then examined, with particular emphasis on detailed case studies of the use of native pinewood, the coppicing of deciduous woodland as a source of tanbark, and coppicing associated with iron smelting. In none of these examples is a significant decline in the quality and extent of woodland attributable to commercial use in the period examined.

It is suggested that commercial use of woodland, as it affected the two counties, was in some cases beneficial in introducing forms of management which temporarily arrested or reversed a process of degradation attributable to other factors. It is also suggested that commercial use in itself had a limited destructive effect, although it contributed to the decline of woodland by making it more vulnerable to this process of degradation during or after periods of exploitation or management.

It is concluded that the decline of woodland in Argyllshire and Perthshire between 1650 and 1850 cannot be explained in terms of destruction by commercial activity; the decline of woodland in this period must therefore be attributed largely to the action of the complex of factors associated with the non-commercial exploitation of the woodland area, in adverse environmental conditions.

I hereby declare that this thesis embodies the results of my own special work, and that it has been composed by myself.

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ABBREVIATIONS

APS	Acts of the parliaments of Scotland. THOMSON,T. & INNES, C., ed. (1814-75) in list of references.
BM(M)	British Museum, London: Map Room.
D & E	Discovery and excavation. Annual publication of the Scottish regional group, Council for British Archaeology.
DNB	Dictionary of national biography. STEPHEN, L. et al., ed. (1885-1900) in list of references.
DOST	Dictionary of the older Scottish tongue. CRAIGIE W.A. et al., ed. (1931ff) in list of references.
EUL	Edinburgh University Library.
HMSO	Her Majesty's Stationery Office.
IGS	Institute of Geological Sciences.
M.S.	Military Survey.
MO	Meteorological Office.
NLS	National Library of Scotland, Edinburgh.
NLS(M)	National Library of Scotland, Edinburgh: Map Room.
NSAS	New Statistical Account of Scotland. ANON, ed. (1845) in list of references.
OS	Ordnance Survey.
OSAS	Old Statistical Account of Scotland. SINCLAIR,J., ed. (1791-9) in list of references.
RCAHMS	Royal Commission on the ancient and historical monuments of Scotland.
RPCS	Register of the privy council of Scotland. BURTON, J.H. et al., ed. (1877ff) in list of references.
SHS	Scottish History Society.
SRO	Scottish Record Office, Edinburgh.

SYSTEM OF REFERENCING

Referencing throughout follows the Harvard system, in which reference is made in the body of the text to a uniform identifying code, generally consisting of the author's name and date of publication, and a full description is contained in an alphabetical list of references at the end of the text. In this case the list of references is divided for convenience into three sections, consisting respectively of printed books and papers, manuscript material, and maps, atlases, and plans.

Books and papers are identified by the author or editor's name and date of publication. As reference is frequently made to specific items of information within texts it was thought necessary to indicate the appropriate page numbers in each case in the text reference; page numbers are therefore provided in all but a few instances where this proves impracticable. The date provided is generally that of first publication; where page references in the text are derived from a later edition the date and place of publication of this edition are indicated at the end of the entry in the list of references.

All text references to manuscript material are preceded by abbreviations indicating the archive or library in which the manuscript is held. Manuscripts

are identified by their catalogue or archive numbers, and it has been attempted as far as possible thus to identify individual documents cited and the appropriate page or folio number in volumes. Some manuscript collections have not yet been handlisted or fully catalogued, however, and in these cases it has been found necessary to provide descriptive lists of the material employed, within the list of references. Square brackets are employed in text references to distinguish material described in these lists; it should be noted that the letters and numbers within square brackets have no significance outside the context of this thesis and are not carried by the manuscripts in question. Additional information about this and other means of providing precise reference to manuscript material is contained in the list of references.

Printed maps and atlases are distinguished from books and papers in text references by the addition of the suffix 'm' to the date of publication. Like other manuscripts, manuscript maps and plans are identified in the text by reference to their provenance and their catalogue numbers or pressmarks.

For the purpose of cross-reference each chapter has been divided into numbered sub-sections, as listed in the table of contents, and in the text cross-references are indicated by the appropriate number in brackets.

MEASURES AND VALUES

The measures employed in Scotland before the middle of the nineteenth century are not always readily related to those in modern use. In some cases the nature of a measure varied on a regional basis or in relation to different commodities; in other instances a measure was nominally uniform but in practice elastic enough in dimensions to prevent direct comparison with those at present employed. Difficulties of this type are discussed at appropriate points in the text.

Specific Scottish linear, areal, and volumetric measures differed from their imperial namesakes to some extent. To facilitate comparison values are here stated wherever possible in imperial terms, and where Scottish measures are employed this is indicated in the text. Each value is accompanied by a metric equivalent of a comparable degree of precision. Metric equivalents are omitted on the second and subsequent appearances of any one value in a given paragraph, and no equivalents are provided in the case of certain measures which cannot uniformly be related to those at present in use; these include the volumetric ton used in the sale of timber, the stone and bolls employed as measures of bark, and the dozen of charcoal.

Twelve pounds Scots or eighteen merks were equivalent to one pound sterling; although officially super-

seded in 1707 these Scottish units remained in common use until the second half of the eighteenth century. Monetary sums are however expressed here in terms of sterling, except where otherwise stated in the text.

CHAPTER ONE

THE DECLINE OF WOODLAND IN THE SCOTTISH HIGHLANDS

1.1 Introduction

At present natural or semi-natural woodland covers an insignificant proportion of the surface of the Scottish Highlands. Great Britain has one of the smallest proportions of woodland among the European nations, and when the last census of woodland was carried out in 1947 only 6.5 per cent of the surface was wooded. At that time most of the Highland counties had proportions below or slightly above the national average; natural and planted woodland together covered less than four per cent of the area north of the Great Glen, and the proportion exceeded ten per cent only in the counties of Moray, Nairn, Aberdeen and Kincardine, all markedly affected by planting (Stamp & Beaver (1963) 158).

In comparison to this, the map prepared by McVean and Ratcliffe to represent the probable extent of woodland in Scotland before human intervention suggests that considerably more than half of the Highland mainland was under wood as recently as 500 B.C; there has also been a decline in the proportionate importance of Scots pine and oak, both of which were formerly important components of the Highland

woods, in relation to birch (McVean & Ratcliffe (1962) 10, maps A, B.). Twenty per cent of Scottish woodland was classified as scrub in 1947, and much of this was in the Highland counties (Stamp & Beaver (1963) 157-9); poor scrub of this type is almost certainly not the optimal form of tree growth in Highland conditions (Chard (1953) 126, Edlin (1956) 104).

The woodland of the Highlands therefore appears to have declined considerably in area, variety, and quality since the coming of man. This thesis sets out to examine the factors responsible for this, and in particular to examine those affecting a specific part of the Highlands during a certain period of time.

1.2 Factors affecting the extent and quality of woodland

Woodland may be described as including all communities of vegetation in which tree species are dominant. In ecological terms a community may be defined as a group of plants of two or more species capable of growing together in a particular habitat, organised in composition and structure as a result of interaction among the component plants and interaction between them, singly and collectively, and their environment. The dominant species is that which comprises the largest proportion of the total mass of living plant matter in the community, and is therefore able to exert the greatest influence on the other members of the community and on their environment; the dominant

species is generally the tallest and largest in the community (Tivy (1971) 158-61). Scattered trees do not constitute the dominant species of woodland communities, and woodland communities do not consist only of trees.

In most cases the subordinate species are recognisably stratified, each stratum having a species which is dominant at that level in the hierarchy; not all may be present in each case, but it is usually possible to identify shrub, field, and ground layers in woodland; the shrub layer is at times dominated by the ligneous species like hazel which in other circumstances may be prominent in the tree layer (McVean (1964a) 146). A distinction is frequently made between woodland and scrub; the latter may be described as woodland in which the dominant trees are markedly inferior in stature and form to those of other woodland communities with the same dominants. Scrub may be found in adverse environments like the exposed upper margins of woodland, but it also occurs in a large number of cases where the quality of the dominant trees is lower than might be expected in a given environment.

The survival of woodland communities depends on a satisfactory relationship between the rates of wastage and replacement of the dominant species; the decline of the woodland of the Highlands may be seen in the broadest terms as a result of the inability of regeneration to balance all forms of wastage. The death of old or diseased trees and the occasional destruction of healthy mature trees will

create vacancies in any area of woodland, but in favourable conditions such depletion will be counteracted by regeneration; if the overall rate of replacement is lower than the rate of wastage, however, decline is inevitable. The loss of mature trees may be the most conspicuous feature, but the decline and ultimate disappearance of woodland is primarily the result of inadequate regeneration; this may be associated with a decline in the rate of replacement or an acceleration of the rate of wastage which cannot be balanced by replacement at the established rate.

Regenerative failure may be initiated by an increase in the rate of wastage; the opening of the canopy formed by the trees of a woodland community may permit the development of types of subsidiary vegetation which hamper the regeneration of tree species, and if environmental conditions are unfavourable degradation of vegetation and soil may continue until regeneration of tree species on the site is no longer possible (Dimbleby (1965) 357-8). A reduction in the rate of replacement will eventually lower the number of trees available as sources of seed in a given area, and this in turn may reduce farther the rate of replacement. When established the process of decline therefore tends to accelerate, and a marked improvement in environmental conditions may be necessary before woodland again becomes stable in form and dimensions.

The relationship between wastage and replacement provides a general explanation for change in the extent

and quality of woodland; the difference between individual cases depends on the nature and relative importance of the factors affecting this relationship. Such factors may be classified as physical or biotic, the first category including the effects of the inorganic components of an environment and the second consisting of the effects of living organisms, but such a classification is not entirely satisfactory. Firstly, it is now recognised that in ecological terms the physical and biotic factors which compose the environments of living plants often interact in ways which do not permit distinction between their effects; secondly, it is also recognised that anthropogenic factors, those arising from the activities of man, are often distinct in form and significance from other biotic factors (Tivy (1971) 83-4,91). It is therefore more satisfactory to divide factors acting on plant communities into two groups, one including only the anthropogenic factors; no adequate collective term exists to describe the other group of physical and biotic factors which affect vegetation. The adjective 'natural' is commonly applied but undesirable in suggesting that human action is fundamentally unnatural; the adjective 'environmental' is not completely adequate but is less misleading, and shall be used henceforward in this context.

Every factor contributing to the decline of woodland in the Highlands may be classified as environmental or anthropogenic. Environmental factors are clearly dominant in the absence of man, and it may be expected that a

specific type of vegetation will be found wherever a certain group of environmental factors occurs; this is the basis for the ecological concept of the climax community, which may be defined as that which is best adapted to a given environment, remaining in equilibrium with it and maintaining itself substantially unchanged. The earlier theorists assumed that vegetational patterns could be divided into a finite number of climax communities differentiated on climatic grounds; more recently the dominance of climatic factors has been questioned and it has been suggested that the climax community of a specific site will be determined by the interaction of the whole range of environmental factors affecting the site (Tivy (1971) 211-12).

If this modification is accepted it must also be accepted that an infinite range of individual climax communities is possible, although general climax types may be recognised. In addition, a community dependent on total interaction can remain genuinely in equilibrium with an environment only as long as the overall relationship of environmental factors remains constant. Communities develop an inertia which prevents rapid adaptation to environmental change, however, and despite the theoretical sensitivity of communities to every change there appears to be a general time lag between any environmental alteration and the corresponding modification of vegetation. This is especially true of woodland communities, which may be preserved by the long life-span of the dominant species in environments which have become unfavourable; in such cases

radical change may finally be precipitated by relatively small changes in the factors acting on the community. It has been suggested that vegetation tends toward the climax form but is prevented from attaining it by the instability of environmental conditions (Pearsall (1959) 95-7, Smith (1965) 339-40, Tivy (1971) 213-14).

It therefore cannot be certain that true climax woodland communities ever existed in the Highlands, but it is evident that conditions are now less favourable for woodland than in the past. Environmental factors are likely to have been partly responsible but anthropogenic factors must also be considered. There is no evidence that any area of British vegetation has totally escaped burning, grazing by domesticated animals, or deliberate modification and destruction for cultivation and other purposes. Existing communities have all therefore been anthropogenically modified to some degree; some have attained a new equilibrium incorporating anthropogenic factors but in other cases continued change in human use has prevented the creation of stable modified communities. In British conditions self-sown woodland cannot truly be described as 'natural', and the term 'semi-natural' is more appropriate in the definition of the present modified communities.

1.3 Factors affecting the extent and quality of woodland in the Highlands

The accuracy with which the factors affecting woodland may be determined and analysed depends on the techniques

available; the vegetational history of the Highlands may be studied with the aid of ecological, palynological, archaeological and documentary evidence; each form presents distinct advantages and problems and is valuable in relation to a limited period. Ecological analysis of the structure and dynamics of plant communities in the field is a relatively recent technique; systematic description of Scottish vegetation in ecological terms was initiated by Tansley in 1939, and since then the vegetation of Scotland has been analysed in the work of McVean and Ratcliffe and in a series of papers edited by Burnett (Tansley (1939), McVean & Ratcliffe (1962), Burnett, ed. (1964)). Field analysis cannot be regarded as a historic technique in itself until records have been maintained for a considerable time, but it provides valuable information about the form and dynamics of existing communities; extrapolation from present patterns facilitates interpretation of historical evidence.

Palynology is based on the identification of pollen grains preserved in peat and other organic deposits; study of the relative importance and stratification of different pollens on a site permits inference about past vegetational patterns (Pennington (1969) 5). The technique has since 1945 been increasingly utilised in the study of post-glacial British vegetational history. Unfortunately peat accumulates slowly and human colonisation accelerates change until pollen analysis is no longer reliable (Birks (1970) 843); although techniques have been developed which allow identification of the earlier stages of colonisation and clear-

ance, analysis tends to become tentative and imprecise when extended into the historic period (Turner (1962) 338, Turner (1965) 353, Hayes (1967) 160-1, Pennington (1969) 62-6). Attention in Scotland has therefore been concentrated on the phases of vegetational history before the major period of human colonisation.

Archaeological research is primarily valuable in this context as a supplement to other techniques; knowledge of the type and distribution of agricultural methods and demands for the produce of woodland may facilitate interpretation of palynological data or augment unreliable and fragmentary documentary evidence. Archaeological evidence should ideally provide information about the period between the initial disturbance of vegetation by man and the development of adequate documentary sources, and archaeological and palynological techniques have effectively been combined in the study of prehistoric communities in Britain (Smith (1970) 82-92). Unfortunately archeological and documentary data relating to the Highlands are not always immediately compatible and little attempt has been made to reconcile them (MacKie (1970) 6); emphasis in the archaeological study of the Highlands remains prehistoric.

The historic period in Britain may be taken as that for which written records survive, commencing with the Roman occupation in the first century A.D. Although there is some palynological and archaeological evidence relating to Highland Scotland during the Roman occupation and the following few centuries documentary evidence, which

includes all forms of written records, maps and plans, is the primary source relating to the second half of the period; it is probable that few records were kept relating to the Highlands until late in the historic period, however, and surviving documentary evidence relates almost entirely to the seventeenth and later centuries. It may therefore be said that there is a lacuna in the sequence of evidence, which may in future be filled by extension of the range of palynological and archaeological evidence; descriptive documentary material provides the main source of information between the seventeenth century and the very recent development of systematic ecological analysis.

The relative importance of different environmental factors in the formation of stable communities need not be discussed here; the significance of individual factors varies greatly from one community to another. Certain factors have particular significance in initiating change, however, and climatic alteration appears to be the most important of these. Minor changes in temperature, precipitation and other climatic factors may have critical effects on the viability of communities (Lines (1973) 104-5); the palynological approach to vegetational history is based on the assumption that such climatic change has predictably been followed by modification of vegetation. Major climatic changes appear from palynological evidence to have occurred at intervals greater than two thousand years in the post-glacial period as a whole, but evidence relating to the historic period indicates that climatic periods

lasting for only a few hundred years may have significant effects on vegetation (Lamb (1964) 387-8).

The time which elapses before vegetation achieves an approximate equilibrium with a changed environment cannot be quantified, but may also perhaps be considered in terms of hundreds of years. Other environmental factors do not in themselves generally initiate change at rates significant to vegetational patterns. Modification of landforms and soils is generally very slow while climate remains constant, but climatic change may cause rapid alteration directly by modifying the quantity of precipitation and evaporation and indirectly through effects on vegetation (Walton (1968) 9-12). Communities are composed of organisms with short life spans, and change initiated by biotic factors appears to be significant largely in affecting the internal structure of communities in the short term; change in biotic factors over longer periods seems mainly to be a response to climatic change.

The manner in which climatic factors affect the woodland of the Highlands makes it unlikely that unbroken woodland cover has ever existed. The climatic variation associated with change in latitude and altitude influences the quantity and species composition of woodland; there is no evidence that the direct effects of latitude have prevented the growth of trees in any part of Scotland, but it is possible to identify a tree-line above which the effective regeneration of tree species is not possible (McVean & Ratcliffe (1962) 11,361). In the Cairngorms palynological

evidence indicates that the tree-line has been no higher than 2,500 feet (763m.) in the more favourable post-glacial climatic periods; in the sub-Atlantic period after 500 B.C. it fell below 2,000 feet (610m.) and the present tree-line in the Cairngorms commonly occurs at 1,600 feet (488m.) (Pears (1967a) 819), Pears (1968a) 380-4).

Direct and indirect human action may have lowered this tree-line to some extent, but Pears identified wind exposure as the principal determinant of the altitude of tree growth in the Cairngorms (Pears (1967b) 123); the tree-line is markedly lower in the more exposed western parts of the British Isles and in the Highlands descends from 1,600 feet (488m.) or more in the east to altitudes under 1,000 feet (305m.) in the north and west (McVean & Ratcliffe (1962) 149). It may be noted that the head dyke, which marks the approximate limit of former cultivation, is as high as 1,200 feet (366m.) in the Cairngorms but generally below 200 feet (61m.) on the west coast (Robertson (1949) 8-12, Pears (1968a) 388-91). Considerable parts of the upper levels of the Highlands, especially in the west, are likely to have been devoid of woodland throughout the post-glacial period.

It is also probable that complete woodland cover has never existed below the tree-line. Trees have probably been consistently absent from steep unstable slopes and the most poorly drained lowland sites (Fairhurst (1939) 195-7); the development of blanket peats on the gentler upland

slopes following increases in precipitation may have reduced the area of woodland during periods of markedly oceanic climate (below, 2.3). This occurred to some extent during the period between 5500 and 3000 B.C., which is generally regarded as the post-glacial climatic optimum; in the last millenium B.C. a second and colder period of intense oceanicity led to the renewed formation of blanket peat, which probably replaced both coniferous and deciduous woodland at high levels throughout the Highlands and also on the gentler slopes below the tree-line in the north and west (Pennington (1969) 55-7, 84-5).

Many such sites were not recolonised by tree species, and the two major strata of debris found in many Highland peat deposits appear to be associated with these periods of increased oceanicity (Donner (1957) 226). Radiocarbon dating of a sample of this timber has demonstrated that it was in fact alive before 2000 B.C., although superficially appearing to be much more recent in origin (Lamb (1964) 392). When the Roman invasion took place woodland was therefore limited by a tree-line which probably fell from 2,000 feet (610m.) in the east Highlands to about 1,000 feet (305m.) in the west, and extensive areas below this line were also devoid of woodland as a result of climatic change. Continued change has been recorded; a minor climatic optimum during the eleventh and twelfth centuries appears to have been followed by a period of adverse climatic conditions which began in the late fifteenth century and ended in the first half of the nineteenth century (Manley (1965) 371-2).

In the historic period, however, the effects of environmental factors can no longer be distinguished from those of human occupation.

The anthropogenic factor most likely to have been common to all British cultures is fire, which may in some cases have been accidental but in others was probably employed to clear ground, restore soil fertility, or rejuvenate vegetation. The role of fire in clearance has perhaps been more limited than is supposed; mature deciduous and coniferous trees burn with difficulty in Britain and permanent deforestation will follow burning only if conditions are unsuitable for regeneration (Aiton (1811) 69, Edlin (1956) 85-6). When land is already cleared, however, regular burning may prevent the regeneration of tree species.

A more significant danger to woodland has been the intensification of grazing pressure after the domestication of grazing animals. Most forms of vegetation are subject to grazing by feral animal populations, but pressure on resources generally intensifies when domestication takes place. Domesticated animals are protected from predators and populations therefore tend to increase. Their greater feeding requirements can be met in part by elimination of feral competitors, controlled movement between pasture grounds, and the use of new forms of fodder; pastoralists aim to maximise production rather than to achieve equili-

brium with existing resources, however, and populations tend toward the greatest size which available resources can support (below, 4.2). It is therefore likely that grazing intensity will ultimately reach a level at which damage is caused to woodland; seedlings and young growth are especially vulnerable, and intense grazing may therefore slowly destroy woodland by preventing regeneration.

Woodland has also been cleared to make way for temporary and permanent tillage; the effects of such clearance are more immediate and drastic. Regeneration may follow temporary cultivation but the development of settled agriculture with permanent tillage is a serious danger to woodland; even in cases where regular cultivation of a site ceases after a number of decades or centuries, continued grazing and intermittent tillage may be sufficient to prevent the return of tree species. The produce of woodland is also of value in itself and subject to exploitation, which can be defined in relation to woodland as the intermittent or sustained removal of timber and other woodland produce without regard to the replacement of losses (Petrini (1953) 5). It is not invariably harmful, and includes a large number of activities ranging in character from the gathering of seeds as food to the clear-felling of extensive areas of timber for profit.

Exploitive activity may damage mature timber; certain forms of exploitation also prevent adequate regeneration, especially when associated with uncontrolled grazing.

Many nomadic groups make some use of woodland produce, but the development of settled pastoralism and cultivation creates demands for building timber and wood for implements, fences and other requirements. Agricultural communities often make thorough use of the resources offered by woodland (below, 3.1); settlements may therefore be surrounded by zones within which woodland is extensively exploited, and regular disturbance caused by the movement of men and animals provides an additional obstacle to regeneration in the immediate vicinity of settlements. As populations increase in size and number fewer areas of woodland remain free from such pressure.

A second stage of exploitation is indicated by the development of trade in woodland resources; this may initially be a means of rectifying imbalance of resources on a local scale, but in more advanced societies the development of full-time crafts may provide centralised markets, and exploitation may ultimately reach a regional or national scale. Exploitation of this type is sometimes succeeded by woodland management or forestry, in which a principal aim is to maintain a high level of yield without destroying resources; this may be achieved by careful management of existing woodland or the planting of new areas. Efficient forestry is largely a development of the last few centuries, but coppicing and other basic management principles appear to have been understood and employed to some extent in primitive societies (below, 7.3).

All the anthropogenic factors outlined above have acted in northern Scotland, but it is not possible to evaluate the importance of individual factors or their collective significance in relation to environmental change. Mesolithic hunting and fishing communities occupied parts of the Highland coastline before 3000 B.C. (Akinson (1962) 1). An increasing body of palynological and archaeological evidence indicates that non-agricultural mesolithic populations modified upland vegetation in the British Isles; fire appears to have been the main mechanism, and may have been employed to improve hunting conditions (Simmons (1969) 116-18), Smith (1970) 81-2). There is at present no direct evidence of mesolithic clearance in the Highlands but fire was certainly employed by later cultures; Durno and McVean found evidence of a long sequence of fires in the vegetational history of Beinn Eighe in Wester Ross (Durno & McVean (1959) 236).

Palynological evidence is at present generally interpreted as indicating that in the British Isles as a whole anthropogenic factors have been more significant than environmental factors in modifying vegetation since the beginning of the neolithic period (Turner (1970) 97-8). Neolithic cultures were established in the British Isles before 3000 B.C., but cultural innovations appear to have reached the northern and western parts of Britain relatively late (Pennington (1969) 74-5). Archaeological evidence also indicates that the Highland interior was not immediately affected by factors active on the margins of the

region; it is therefore possible that the interior was subjected to anthropogenic pressure considerably later than the margins, although palynological evidence is too slight at present to indicate whether this is the case (Pennington (1969) 74).

In the earliest British agricultural cultures small areas were cleared and cultivated for a few years while they remained fertile; tree species generally but not invariably seem to have returned after the sites of such clearance were abandoned.(Turner (1964) 87-9, Turner (1965) 348-9). Clearance of this type has been identified in Scotland. Turner found that small clearances could be traced in upland Ayrshire after about 1800 B.C., but that extensive clearance there and near Flanders Moss on the upper Forth did not predate the Roman period (Turner (1965) 353); the first such clearance in Glen Shee on the southern Highland margin, however, has been assigned by Durno to the third millenium B.C. (Durno (1965) 18-19). Agricultural populations were established on the west Highland coast by the beginning of the second millenium B.C., but as late as the beginning of the historic period activity seems still to have been confined largely to the coasts and major river valleys (Kirk (1957) 65-9, MacKie (1970) 6-7, Maps 1-4).

As already indicated, little evidence is available concerning most of the historic period, and it is not possible to estimate the relative importance of different anthropogenic factors. The Highland economy appears to

have been consistently pastoral, however, and by the seventeenth century settled pastoral populations cultivating small areas as a supplementary source of food were established throughout the Highland area. It may therefore be suggested that the damage caused by grazing animals has been prominent among anthropogenic pressures, but the effects of fire, the cultivation of cereals, and the exploitation of woodland produce for local use cannot be disregarded, and there is evidence of a minor internal and external trade in timber before the seventeenth century (below, 5.4, 8.2). As previously observed, climatic fluctuations continued during this period, although their effects may have been concealed or modified by anthropogenic factors.

By the seventeenth century Scotland as a whole was sparsely wooded. Little woodland survived in the south and the central lowlands, where shortage had been evident at least as early as the fifteenth century (Murray (1935) 4, Smout (1960) 7). At the beginning of the seventeenth century the Scottish parliament regarded the woods of the Highlands as a potential source of valuable timber, but it is evident that they were fragmented even then (APS V.4 (1816) 408). The manuscript maps of Scotland used in the preparation of Blaeu's Atlas Novus of 1654, some of which may have been prepared before 1600, indicate that there were relatively few large areas of woodland in the Highlands (Cash (1907) 577-92, Stone (1970) 16); seventeenth century accounts of the Highlands also suggest that woods of large timber existed but were uncommon enough to merit individual

description, and there is a general correspondence between those named then and the major semi-natural woods surviving at present (below, 5.2, 7.2).

The earliest reliable large-scale survey of the Highlands was the Military Survey of 1747-55; there is a striking resemblance between the semi-natural woodland shown by the survey and that of the present, both in distribution and in extent relative to the total area of the Highlands (O'Dell (1953) 63, McVean & Ratcliffe (1962) Map A). It may be said that the combined action of environmental and anthropogenic factors reduced the woodland of the Highlands very considerably before the seventeenth century, and that the woodland of the Highlands was similar to that of the present in location and extent by the middle of the eighteenth century. Unfortunately, however, this is not compatible with a widely-accepted interpretation of the documentary evidence relating to woodland in the Highlands, which is based on the assumption that decline took place largely after the beginning of the seventeenth century.

1.4 Explanations of the decline of woodland in the Highlands

The history of Highland vegetation in the historic period has frequently been described since the end of the eighteenth century, both as part of the general history of the Highlands and in relation to the biological and ecological development of the area. As shall be seen, such accounts have generally been dominated by certain basic

assumptions, supported by a body of unsystematised evidence of varied reliability. Both the assumptions and the evidence have been criticised (Fairhurst (1939) 208-9, Steven (1951) 114); they have not been abandoned or substantially modified, however, and continue to be accepted and employed uncritically in the interpretation of palynological and ecological evidence (McVean & Lockie (1969) 6, Tittensor (1970) 101-5). No attempt has been made to re-examine these assumptions in relation to the large quantity of primary evidence available concerning the later part of the historic period.

One of the most persistent assumptions relates to the extent of forest cover at the beginning of the historic period. Roman authors describing Scotland mentioned extensive areas of woodland, including one tract in the Highlands named Silva Caledonia, a term generally translated as 'Caledonian Forest'. The same accounts described the use of chariot warfare and cattle husbandry by the tribes of the Highlands; this suggests that there was not a dense and uniform cover of forest, and Watt has suggested that the name Silva Caledonia was in fact applied to a specific part of the Highlands which was distinct in being well wooded (Watt (1980) 91-2). The Romans did not penetrate the Highland area permanently (Fairhurst (1939) 209); the accounts of the historians were therefore perhaps derived indirectly from the reports of reconnaissance patrols or translations of verbal descriptions in native languages.

Roman accounts of the Silva Caledonia cannot be disregarded; nor can they be taken as reliable first-hand evidence (Murray (1935) 2-3).

These descriptions provided a basis for the persistent later legend of the Caledonian Forest, a vast tract of woodland dominated by Scots pine. Although employed previously, this term appears to have become widely current only at the end of the eighteenth century (Miege (1711) 24, Newte (1791) 258, Aiton (1811 56); successive authors extended the notional boundaries of the former forest, as Roman historians had previously done, until by the end of the nineteenth century it could be defined as having included the whole Highland area except the extreme southwest and the far north and west (Nairne (1890-1) 170-2, Watt (1900) 94-5). Two additional forms of evidence supported the view that the Highlands had been clothed by a dense pine forest which by the nineteenth century was represented only by small and isolated pinewoods.

Firstly, the discovery of sections of timber of varying sizes in the peat bogs of the Highlands and other parts of Scotland has frequently been recorded (Anderson (1967) V.2, 622-39). In the view of some observers the presence of such timber was evidence of the former great extent of the Caledonian Forest (Campbell (1802) V.1, 96-7), MacCulloch (1824) V.2, 152-3); the fresh appearance of bog timber made it seem probable that deforestation had been very recent (Pennant (1771) 183, Lettice (1794) 296). There was considerable debate about the date and mode of origin of peat

bog and bog timber in the early nineteenth century (Aiton (1811) 56-68). In 1866, however, Geikie identified two principal strata of debris among bog timber, and suggested that these were associated with climatic changes preceding the Roman occupation (Geikie (1866) 374-6, 380); more recent findings suggest that this interpretation was substantially correct (above, 1.3).

Secondly, inaccurate interpretation of the term 'forest' has reinforced the view that extensive woodland has disappeared recently. Approximately two hundred separate forests had been recognised or created in Scotland by the end of the seventeenth century (Anderson (1967) V.2, 640-4); it is still occasionally stated that such forests invariably originated as areas of woodland (Aiton (1811) 57, Edlin (1956) 108). In Scotland, however, forests were primarily areas of waste land designated as hunting reserves; woodland may have been present in some and would certainly be valuable in providing shelter in winter, but it was not an essential component and it cannot be assumed that woodland was important or even present in every area defined as forest (Murray (1935) 1-2, Steven & Carlisle (1959) 53-4, Anderson (1967) V.1, 148). Because of this ambiguity the use of the term simply to describe areas of woodland is undesirable in a Scottish context.

It has generally been accepted that the sustained pressure maintained by settled agricultural communities has contributed to the decline of Highland woodland, but

prominence has most frequently been given to factors believed to have caused rapid destruction during short periods; such an emphasis may have been encouraged by the apparent necessity of explaining the disappearance of most of the Caledonian Forest within the historic period. The destruction of woodland by invading armies has been seen by some authors as a principal factor; tracts were supposedly cleared of trees to prevent the concealment of hostile troops (Ritchie (1921) 317). Clearance of this type would in itself destroy mature trees; if environmental conditions were unfavourable recovery would be difficult, and the cleared sites were exposed to the danger of grazing or cultivation.

The Romans allegedly devoted a considerable amount of time and energy to the clearance of woods in Scotland, with the aim of removing cover to which native forces could retreat (Anderson (1967) V.1, 72-3). The historians Herodian and Dio Cassius described the loss of 50,000 men during the campaign of 207-11 A.D. under the emperor Severus, largely in the cutting and clearing of woodland (Watt (1900) 91). Some later observers were prepared to accept that damage of this type during the Roman occupation had been significant (Aiton (1811) 72-7), Nairne (1890-1) 172); the movement of the Roman armies within Scotland was limited, however, and their activity could not satisfactorily explain the widespread decline of woodland in the Highlands.

Destruction of a comparable type has also been linked with later military action. The Viking raids on the north and west Highlands between the ninth and eleventh centuries are traditionally associated with the burning of large tracts (Aiton (1811) 78, Darling & Boyd (1964) 69); Robert Bruce is alleged to have destroyed woods around Inverurie in Aberdeenshire during civil disturbances in 1307 and John of Gaunt is said to have employed 24,000 men to cut woods in Scotland at the end of the fourteenth century (Aiton (1811) 78, Ritchie (1921) 317). During Cromwell's occupation of Scotland General Monk apparently issued orders for the cutting of specific woods in Perthshire which were said to harbour rebels, and as late as 1746 woodland in Morvern was reputedly burned by Government troops in reprisal for the disloyalty of the district (Anon. (1819) 139, Gaskell (1968) 4). It has also been stated that areas of woodland were cleared in the course of clan warfare and during raids by armed bands (Aiton (1811) 76-7), Watt (1952) 23, Darling & Boyd (1964) 69); in a number of cases it has been said that woodland was destroyed in order to remove shelter for wolves, other wild beasts, and thieves (Aiton (1811) 78, Ritchie (1921) 318-19).

Clearance was strategically valuable in removing cover from which hostile forces could launch unexpected attacks and to which they could retreat; it was therefore generally desirable, but it is probable that logistic difficulties often made clearance impracticable. Mature trees burn with

difficulty in British conditions (above,1.3); it cannot therefore be assumed that woodland was casually destroyed by fire during military campaigns. Felling would be a more reliable means of clearance, but one requiring considerable effort and time both in the felling of trees and in the removal or destruction of the debris, which might itself provide cover. Clearance of such a type was almost certainly undertaken only when it was thought likely to be of sustained value; it is improbable that significant damage was caused during raids and short campaigns.

It may be suggested that if such clearance took place it occurred only during prolonged occupations. It was therefore possibly employed by the Romans on the Highland margin and by governmental garrisons in the Highlands in the eighteenth century; even in these cases it is probable that clearance was confined to the creation of open spaces around fortified sites and settlements, and perhaps along the lines of routes (Murray (1935) 2-3). If clearance to protect settlements and travellers against brigands and wild animals was ever undertaken it is likely to have been restricted to comparable sites; complete clearance could not in itself eliminate the danger, and would therefore represent an unwarranted expenditure of the community's time and labour.

There is little reliable evidence relating to the clearance of woodland in the Highlands for reasons of strategy or security; most of the evidence available belongs to oral tradition and is not uniformly reliable. Some inform-

ation of this type may be accepted with reservations; there is no evidence to contradict Burt's account of the felling of an avenue near Inverness after the assassination of a local dignitary in it (Burt (1754) V.1, 228). In the case of the reprisals in Morvern in 1746, however, the burning of extensive woods at this date had become part of local tradition by 1840, but first-hand accounts of events indicate that burning was confined to houses and personal property (NSAS (1845) V.7 (Argyll),176, Gaskell (1968) 3-4). General Monk's order for the cutting of wood in Perthshire in 1654 appears to have had no effect on the value of the woods on the sites in question (below, 9.3).

There is therefore no body of evidence to confirm the belief that woodland was extensively cleared in the Highlands for these reasons, but legends concerning clearance appear to have found a firm place in local tradition. Such legends may have been developed to explain the frequent occurrence of timber in blanket peat; the timber preserved in peat is frequently blackened and apparently charred, and this has been taken as evidence of extensive burning (Lettice (1794) 296, Aiton (1811) 70-1). It is apparent, however, that superficial discoloration of such timber may be caused by oxidisation after submergence in peat (Lamb (1964) 383). Similar beliefs about burning have been recorded in Ireland, where there are also extensive oral traditions and written records relating to the cutting of woodland to permit the extermination of wolves and fugitive rebels; as in the

case of the Highlands, however, there is no evidence that clearance of this type was in fact carried out (McCracken (1971) 21, 27-9).

The decline of woodland is still at times explained partly in such terms, but more recently, and especially since the beginning of the present century, it has come to be accepted that decline was largely the result of felling to satisfy industrial and commercial markets. It is assumed that such exploitation was carried out between the beginning of the seventeenth century, when the Scottish parliament announced the 'discovery' of the woods of the Highlands, and the middle of the nineteenth century (APS V.4 (1816) 408). It is also assumed that the entrepreneurs were largely English, and it has indeed been stated that the English were responsible for most of the destruction of Scottish forests (Darling (1949) 133). Most accounts suggest that there were three phases of exploitation; iron smelting was established initially then followed by the commercial felling of pine timber and later by the introduction of extensive sheep farming to the cleared land.

Accounts of the history of charcoal iron smelting in the Highlands generally make direct or indirect use of the work of W.I. Macadam, whose paper of 1886 is still the most complete and reliable published account of the role of smelting in the region. Subsequent authors have followed Macadam in assuming that the Highlands had an indigenous tradition of bloomery smelting for local consumption (Macadam

(1886-7) 89-94, Ritchie (1921) 319-20, Schubert (1957) 106). It has also been accepted that commercial smelting developed after 1600, under the direction of English ironmasters forced by restrictive legislation to find sources of fuel in remote areas (Macadam (1886-7) 89, Darling (1949) 133); the expanding industry at first employed bloomery methods but later was consolidated at a smaller number of blast furnaces, which were closed when fuel supplies were exhausted and coke smelting became established (Macadam (1886-7) 89-90, Tylecote (1962) 292, Tittensor (1970) 105).

Macadam identified fewer than ten commercial iron-working sites, but later authors have ascribed other bloomery sites to the period after 1600 or otherwise indicated that smelting was undertaken on a considerably larger scale (Macadam (1886-7) 106-30, Darling (1955) 4, Tylecote (1962) 292); it has also been stated that the coaling of timber for smelting was a wasteful process in relation to the felling of timber for construction (Darling (1949) 133). Iron smelting has consequently been regarded as one of the principal agents in the destruction of the pine and oak woodland of the Highlands (Darling (1949) 133, Steven (1951) 115, Tittensor (1969) 24); some authors have described iron smelting as the single factor most responsible for the destruction of the woodland of the Highlands (Cadell (1913) 150, Ritchie (1921) 319).

The second stage of exploitation was the felling of timber for sale to external markets; attention appears to

have been concentrated on the surviving pinewoods, the supposed remnants of the Caledonian Forest, and felling took place in the seventeenth century. Exploitation accelerated after 1700, and it has been suggested that this followed the development of efficient means of floating timber on Highland rivers (Steven & Carlisle (1959) 58); some authors have asserted that the pacification of the area after the rebellions of 1715 and 1745 permitted timber merchants to operate in the Highlands with some security (Ritchie (1921) 321, Steven (1951) 115). In 1728 the York Buildings Company, which has acquired considerable notoriety as a destroyer of woodland, entered a contract for the purchase of timber in Strath Spey; this date has been taken by some to mark the beginning of the first phase of significant commercial felling of pine (Darling (1949) 133-4, Hamilton (1963) 64-5).

Exploitation of this kind is said to have reached a peak at the end of the eighteenth century, when the more remote woods of the Strath Spey group were finally affected by commercial felling (Nairne (1890-1) 199, Steven (1951) 115). There was a general decline in the following century and little felling took place between 1850 and 1914 (Steven & Carlisle (1959) 58-9). Shipbuilders are thought to have provided a major market for Highland timber, but some authors have stated that pine timber was in fact commonly coaled for smelting (Nairne (1890-1) 195, Darling (1949) 133, Watt (1952) 23, O'Dell & Walton (1962) 148); the York Buildings Company is said to have built a furnace to make use

of pine timber which proved inadequate for the production of masts (Ritchie (1921) 321).

The final phase of commercial exploitation was the development of extensive sheep-farming, a form of land use which reached the south Highlands about 1760 and had affected the whole region by 1850 (Gray (1957) 86-8). Sheep-farming has become notorious as the cause of the social hardship associated with the Highland clearances (Symon (1959) 274-5); it has also been widely described as a major error in land management and one of the most important factors in the decline of the Highland woods (Darling (1949) 134, Watt (1952) 23, Black (1965) 8, Tittensor (1969) 24). Like other grazing animals sheep inhibit regeneration of tree species by destroying young growth; unlike mixed pastoralism, however, the grazing of sheep alone impoverishes ground vegetation; this can be counteracted most readily by repeated burning, but in Highland conditions this makes regeneration even more difficult (Darling (1955) 169-71, Black (1965) 8). It has been suggested that woodland was stocked with sheep as soon as the trees were sold and felled; in some cases woodland is said to have been cleared solely to make way for sheep (Darling (1949) 134).

It has already been noted that clearance for strategic purposes is very unlikely to have been significant in the decline of woodland in the Highlands; exploitation of the types described above may therefore have been principally responsible for the destruction of woodland.

It has also been noted, however, that cover was already fragmentary in the seventeenth century and comparable in dimensions to that of the present by the middle of the eighteenth century (above, 1.3); exploitive pressure intensified after 1750. The largest and longest-lived smelting furnaces were erected after that date, which also preceded the greatest development of sheep-farming and the felling of pinewood (Macadam (1886-7) 89-90). A census of woodland taken in 1812 indicated that semi-natural woodland covered less than three per cent of the area of Scotland and perhaps a slightly higher proportion of the Highlands (Anderson (1967) V.2, 187); the Military Survey suggests that it occupied a similar proportion in 1750, and the area of semi-natural woodland is probably not greatly different at present (above, 1.1).

Exploitation therefore appears to have had a very limited effect on the relative importance of woodland in the Highlands during this period, and it may be suggested that the less intense exploitation of the period before 1750 had no greater effect. Commercial exploitation was sustained by the use of a very limited part of the total area of the Highlands; it must be accepted either that exploitation was less extensive and severe than has previously been suggested, or that it was extensive but did not have markedly destructive effects. It must also be accepted, if clearance for strategic purposes and commercial exploitation have not been major factors in the overall

decline of the Highland woods, that the decline has resulted largely from environmental change and the continued action of the anthropogenic factors associated with agricultural communities.

As already indicated, these factors have generally been given a subsidiary role in descriptions of the woodland history of the Highlands (Walker (1812) V.2, 198,Geikie (1866) 372-5, Ritchie (1921) 308-9, Fairhurst (1939) 210-11, Steven (1951) 114). This may in part be due to the slow and often imperceptible operation of such factors; it appears to have been found that change could more easily and simply be explained as the result of factors operating in a series of discrete events or well-defined phases. Some authors, perhaps influenced by preconceived ideas about the role of external agents in the Highlands, have consciously or unconsciously exaggerated the difference between the effects of a stable and well-balanced rural society and rapacious, irresponsible exploitation by external commercial interests (Nairne (1890-1) 195-7, Darling (1949) 133, Black (1965) 7-8).

Other factors may have encouraged disproportionate attention to strategic clearance and commercial felling. Many authors have relied on local and national histories, which tend to emphasise discrete and memorable events rather than slow and prolonged processes; such sources also often make use of legend and local tradition and must be used carefully. Unfortunately, some authors, even

when trained in historical methods, have uncritically accepted evidence available in such forms; thus passages in the early histories which contemporaries probably recognised as literary devices have been taken by later authors as concrete evidence (Fairhurst (1939) 209). Published accounts of the woodland history of the Highlands have repeatedly been utilised as basic sources for later accounts; errors have therefore been perpetuated and in some cases compounded by alteration of facts and opinions. There is thus a remarkable diversity among descriptions of ironworks in the Highlands which have as their major common ancestor Macadam's paper of 1886 (Ritchie (1921) 319-22, Darling & Boyd (1964) 70-1, Tittensor (1969) 81-2).

Because of their slow and interrelated action the persistent environmental and anthropogenic pressures which appear to have been most important in the vegetational history of the Highlands are those which offer the smallest possibility of elucidation, even if more information about the earlier part of the historic period is provided by the application of palaeobotanical techniques. If the true role of the other factors which have allegedly been important can be established, however, this complex of environmental and anthropogenic factors may be said to account for the remainder of the decline. Clearance for strategic purposes cannot be regarded as a significant factor in itself, and it is probable that commercial use of woodland was relatively unimportant in the overall decline of the wood-

land of the Highlands, but its true role cannot be certain until it has been examined more carefully than has previously been done.

It is possible that the commercial use of woodland was in fact very significant among the factors operating on the diminished woodland resources of the late historic period. It is also likely to have consisted of identifiable episodes rather than a prolonged and irregular process of depletion, and to have taken place during a period in which documentary evidence of such episodes may have been produced. It may therefore be possible to determine the full significance of the commercial use of woodland. This thesis sets out to examine the use of the semi-natural woodlands of the Highlands in the late historic period, with the particular aim of determining the significance of commercial use both in relation to the overall decline of these woods and decline during the period when exploitation is said to have taken place.

1.5 Delimitation of an area and period for study

It is initially necessary to define the uses of woodland which may be described as commercial. The real or anticipated availability of monetary profit is a prerequisite, and in this context commercial use may initially be defined as that in which the production of profit is the principal aim. This definition includes a large number of diverse activities and it may initially be more rewarding to con-

sider those which are excluded. The principal form of non-commercial use occurs when the possessor of woodland employs the produce of woodland to maintain buildings and equipment on his property, or gives his tenants privileged access to the resources of woodland for similar purposes. In some cases Highland tenants obtained timber from their proprietors free of charge or for a nominal payment; in other cases tenants paid the full market price, but the profit to the landowner in such cases may be regarded as an incidental benefit from an established practice (below, 3.3). The relationship between landowner and tenant is such as to make it difficult to regard the use of woodland within the estate as commercial in the sense suggested above.

Commercial use may include the sale of untreated, semi-finished, or chemically modified timber and woodland produce, shaped timber, and manufactured wooden articles. Woodland produce as a whole may be defined as including not only timber but other materials obtainable from trees and other forms of vegetation characteristic of woodland communities; it is not appropriate to include the use of vegetation of types more commonly found outside woodland, however, and the sale or lease of woodland pasture is therefore not regarded as a commercial use of woodland in itself. In terms of these qualifications, the commercial use of woodland may therefore be defined as including any form of utilisation of woodland produce in which profit is the principal aim, and excluding the personal requirements of the possessor of woodland and his tenants.

The number of possible commercial uses of woodland produce is large and not all are likely to have been equally important. Existing accounts of the history of Highland woodland emphasise the importance of iron smelting and the use of pine timber for ship-building and other specialised purposes; examination of both types may therefore prove illuminating. Extensive sheep-farming has also been criticised in this context but examination here is less appropriate. Sheep-farming was undoubtedly profit-orientated but the primary resource was grassland, and the presence of woodland was largely incidental; it cannot therefore be included as a deliberate commercial use of woodland in terms of the definition above. The effects of sheep-farming were essentially identical to the types of grazing damage associated with traditional Highland grazing stocks; it is unlikely that the role of sheep, acting mainly through the suppression of regeneration, could adequately be quantified and distinguished from that of traditional grazing stocks.

One group of commercial uses of woodland which has been almost totally neglected in accounts of the woodland history of the Highlands is that connected with the production of tanbark from coppiced deciduous woodland; only recently has Edlin drawn attention to the large number of contemporary references to formal coppicing in the Highlands in the eighteenth and nineteenth centuries (Edlin (1955) 145-7, Edlin (1956) 103-5). The bark was employed in the tanning of leather and a large number of uses were found

for the timber. Small timber of the type available from coppice was generally preferred by British charcoal iron-masters, and contemporary evidence indicates that coppice timber was commonly coaled as fuel for the iron works of the Highlands (Smith (1805) 137-8, Walker (1812) V.2, 208, Richardson (1922) 181-2, Hammersley (1957) 150).

It is necessary to survey the whole range of anthropogenic factors affecting woodland in the Highlands, but available evidence can give little indication of the true role of many non-commercial activities, and attention will be concentrated on the commercial utilisation of Highland pinewoods, the nature, extent and utilisation of deciduous coppice, and the effects of iron smelting on deciduous coppice and other forms of woodland. Particular attention will be paid to two aspects of these commercial uses. Firstly an attempt will be made to establish how far woodland of each type was exploited and how far it was managed as a resource capable of sustained production; secondly an attempt will be made to determine the degree to which commercial exploitation and management, singly and together, contributed to the decline of woodland in the Highlands.

It was not thought practicable to attempt to survey the use of woodland throughout the whole Highland area in detail, and it was consequently decided to select for examination one section of the Highlands. As no one area can be totally representative of Highland conditions, it was decided to select an area which was reasonably representative

and in which varied commercial activity is known to have taken place; the two counties of Perthshire and Argyllshire were therefore chosen for examination. Together these counties contain about one quarter of the land area north and west of the Highland Boundary fault and include a variety of characteristic Highland landscapes; Perthshire also contains a long section of the Highland Boundary fault and part of the lowland of the Highland margin (below, 2.1).

The two counties also appear to have contained a more varied woodland than other parts of the Highlands before human intervention, with extensive areas of oakwood and pinewood as well as birch (below, 2.4). This variety may be reflected in the range of commercial uses, which was possibly also increased by the proximity of the two counties to southern markets. The surviving pinewoods are largely in the northern counties, but Perthshire contains one major pinewood which is known to have been utilised for a considerable time. The two counties also appear to have contained a large proportion of the tanbark coppice of the Highlands (Edlin (1955) 147); Argyllshire was also one of the centres of iron-smelting in the Highlands, including the largest and longest-lived charcoal furnaces operating in Scotland.

It was also thought necessary to set approximate limits to the period of time examined, and it appeared most appropriate initially to examine activity during the eighteenth century, which those who consider commercial use to have been significant in the decline of Highland woodland have

generally accepted as being the period of most intense and widespread exploitation. As already noted, however, some forms of commercial use appear to have been initiated before 1700 and others continued for some time after the end of the eighteenth century. It was therefore decided to examine activity during the longer period between 1650 and 1850.

Palynological and ecological techniques are not at present directly applicable to the study of this period, and little relevant archaeological research has been undertaken (above, 1.3); the main means of approach to this problem is therefore provided by documentary evidence, which includes written and cartographic material both in manuscript and printed form. A major fault among accounts of woodland history has been their failure to examine the body of evidence contemporary to the events which they describe and directly relevant to them. In order to avoid the errors intrinsic to the use of derivative later accounts, it is necessary to give preference to contemporary manuscript collections, reliable transcripts, and contemporary publications. It is of particular interest to discover the extent to which documentary evidence provides information in a form which facilitates the systematic examination of the area in spatial and temporal terms.

One form of documentary evidence of great potential value in this context is the cartographic record of the extent and distribution of woodland in the area at different times. Unfortunately the range of maps available is

for a number of reasons limited in value in this context. The maps of the earlier part of the period were pictorial and symbolic in emphasis, with little apparent concern for accurate measurement and representation true to scale. In the seventeenth century and in some cases as late as the end of the eighteenth century the tree symbols employed on maps were intended to indicate the presence of woodland but not the exact dimensions; it is also evident that in Scottish cartography, as in other parts of the British Isles, tree symbols were used in some cases as embellishments in places regarded by the engraver as appropriate (Yapp (1953) 198).

Few original surveys were undertaken until the middle of the nineteenth century, and most cartographers made use of the works of their predecessors. Thus in Dorret's General Map of Scotland of 1750, which was itself copied by later publishers, the map of Perthshire was based on surveys made by Edgar in 1744 and 1745 but part came indirectly from Adair's manuscript map of Strathearn, made about 1685 (NLS (M) Case 8A.2, 2, SRO RHP.1903 BM(M)K.Top.50.69, Dorret (1750m)); the representation of the Argyllshire islands followed that of the maps in Blaeu's Atlas Novus of 1654, and may have been based on surveys made before 1600 (Megaw (1969) 71-2). This is not an isolated instance; few maps of Highland Scotland produced during the period can be assumed to represent the true pattern of woodland at the time of publication.

A few early maps which appear to be based on original surveys at known times, like the maps of south Perthshire produced by Adair in the 1680s, are valuable but cover only a small part of the total area (NLS(M) Case 8A.2, 2, 5, BM(M) K.Top.48.44). The first survey of Scotland based on a uniform and relatively accurate field survey was the Military Survey, sometimes known as Roy's Map of Scotland. The history and technical character of this survey have already been described several times elsewhere (Arrowsmith (1809) 7-9, O'Dell (1953) 58-9, Skelton (1967) 5-9); it may be observed here that the whole of Highland Scotland except the western isles was surveyed by several military parties between 1747 and 1752 at the relatively large scale of 1/36,000.

The survey was intended to serve as a 'military sketch', a form of survey which, as Skelton has pointed out, emphasises the form and location of woodland and other landscape features which may be significant in the deployment of troops (Skelton (1967) 11-12). The omission of the islands reduces the value of the survey to some extent, and the quality of work carried out by different surveyors varies greatly. It is also evident that accurate survey along measured base lines was accompanied by the sketching by eye of the surrounding detail (Skelton (1967) 8); the survey is therefore in general most reliable along the lines of valley bottoms, and frequently very inadequate in the depiction of tributary valleys and upland areas. Despite

these faults, the Military Survey is of undoubted value in this context if it is interpreted with some caution.

Later county maps based largely on original survey are available both for Perthshire and Argyllshire. Stobie's map of Perthshire was published in 1783 at the scale of 1/63,360 (Stobie (1783m)); the map of Argyllshire by George and Alexander Langlands was published in 1801 at the scale of 1/126,720 (Langlands & Langlands (1801m).) Both are rather coarse and imprecise in execution and the Langlands map contains several major errors of proportion; George Langlands was active as a land surveyor in the county as early as 1777, and the county map may therefore be in part a compilation from his own earlier surveys (SRO RHP.4300). Neither map is totally satisfactory, but both provide some information about woodland between the production of the Military Survey around 1750 and the first Ordnance Survey maps of the Highlands at scales of 1/10,560 and 1/63,360 after 1850.

The limitations of scale prevent the depiction of detailed woodland patterns on maps of this type, which consequently cannot accurately show the species composition and relative density of woodland. The existence of large-scale estate plans compensates to some extent for this deficiency; some plans, especially those accompanied by written texts, are very valuable in this respect (SRO RHP.3480, E.783/98). Estate plans were commissioned by individual landowners and generally remain in manuscript form. The production of plans by trained land surveyors was associated

with the agricultural innovations which affected Scotland in the late eighteenth century; few of the plans available therefore predate 1740, and most belong to the period between 1770 and 1850 (Adams (1968) 248-9).

Few plans are therefore available relating to the first half of the period. Not all landowners commissioned plans and the overall pattern of coverage is incomplete; few were produced on the more remote estates and in the less prosperous counties, and the number of surviving plans relating to Argyllshire is small in comparison to the number depicting Perthshire lands. During the survey of an estate attention was concentrated on land of potential agricultural value, and in some cases large areas of upland were therefore excluded from detailed survey (Adams (1970) xii-xiii). Estate plans provide a detailed record of woodland patterns in small areas, whereas small-scale maps indicate generalised patterns on a regional scale; coverage of both types appeared at irregular intervals and emphasis was generally on the second half of the period. Cartographic evidence is therefore not amenable to systematic use in this context, although the maps available are valuable in specific instances.

Manuscript estate papers provide the most valuable source of primary written evidence in this context; many Scottish manuscript collections contain material relating to the management of estates and farms, which may provide detailed information about the treatment of woodland.

Estate management is a continuous process and estate papers may therefore clarify the relationship between the condition of woodland and the factors affecting it over a period of time. Unfortunately the systematic form of estate management associated with the keeping of records was also largely a feature of the period of agricultural improvement; collections of estate papers generally relate to the more fertile areas during the second half of the period; they cannot therefore be used as the basis for a systematised approach to the two counties as a whole.

A third possible means of obtaining such information is provided by published general surveys. A series of seventeenth and eighteenth-century topographic accounts generally known as Macfarlane's Geographical Collections contains interesting information but is too loose in structure and incomplete to be of value as a source of systematically organised information (Mitchell, ed. (1906-8), Emery (1959) 1-9). The first or 'old' Statistical Account of Scotland, produced between 1791 and 1798, the Board of Agriculture county reports published between 1793 and 1816, and the second or 'new' Statistical Account of Scotland of 1845 are all recognised as invaluable sources of information in many fields, but all are late in date and generalised in nature.

There is therefore insufficient documentary evidence to permit systematic examination of the two counties as a whole. Some of the surviving collections of estate papers

and other manuscripts provided detailed information about parts of the area during much of the period, however, and in the absence of uniform coverage it appears most appropriate to select examples from this group for examination as case studies. It cannot be certain that such examples will prove representative, and it is necessary to relate them as far as possible to independent evidence from other manuscript collections and published material, including official records, general surveys, and accounts of travel in the region. The problem shall therefore be approached by the use of case studies within a flexible regional framework.

The regional framework has been retained for a number of reasons. Firstly, examination of the varied uses of woodland in a common context reduces the danger that the nature and relative importance of individual uses might be misrepresented. Secondly, the study of examples of different commercial uses in relatively close proximity to each other may indicate the extent to which the requirements of these activities were complementary or conflicting. Thirdly, it is believed that the examples chosen for examination are representative of a pattern of commercial activity which may prove to have been characteristic of the south Highlands and distinct from other Highland regions; study in a regional context may therefore provide the basis for future examination of regional distinctions.

The regional framework must nevertheless be elastic.

Very little research has been carried out in relation to any aspect of the present field of study in the period in question; the context of the topics studied in detail must therefore be examined in a way which would not otherwise be necessary. The examples of commercial use selected for study must be examined in relation to the overall development of the activities in question, which cannot adequately be described if reference is made only to developments within the two counties during the selected period. A survey of the non-commercial uses of woodland in the area must be dependent on a limited quantity of fragmentary information, but this may be supplemented by information about comparable patterns in other Highland areas.

After an initial survey of the nature of the counties of Argyllshire and Perthshire, the use of timber and wood produce in the rural economy and the use of woodland for grazing and other purposes in the period 1650-1850 will be examined. The utilisation of pinewood will then be surveyed, with particular reference to the management of the pine wood of Rannoch in north Perthshire between 1749 and 1784; during this period the wood was under governmental administration and surviving records in the Scottish Record Office provide a large amount of information about the management of the wood and the markets available for the produce.

The utilisation of deciduous woodland as coppice will then be surveyed; particular attention will be paid to the nature and quality of coppice management in Highland Scotland and the range of markets available for the produce.

The management and utilisation of the extensive coppices of the Montrose lands in southwest Perthshire in the period 1650-1835 will then be examined; the Montrose muniments in the Scottish Record Office provide a discontinuous but exceptionally long record of coppice management. Finally the role of iron smelting in the woodland history of the Highlands will be surveyed. The works operated by the Lorn Furnace Company at Bonawe in Argyllshire was one of the largest in the Highlands and remained in operation for more than a century; examination of the letterbooks and other documents of the company relating to the period 1786-1813, now housed in the National Library of Scotland, may indicate the true significance of this use of woodland.

1.6 Summary

The woodland of the Scottish Highlands has declined considerably in extent and quality since the arrival of man in the region. Woodland was fragmented in the seventeenth century and comparable in extent to that of the present by 1750; this may be attributed largely to climatic deterioration and sustained anthropogenic pressure from settled agricultural communities.

Most histories of the Highland woodlands have however emphasised the importance of rapid decline resulting from the clearance for strategic purposes and cutting for commercial gain. The first of these factors may largely be discounted and commercial felling is said to have taken

place largely after 1750, when the decline of woodland in the region was already advanced. In view of the importance still attached to commercial exploitation as a factor in the decline of woodland, however, it was decided to examine the use of woodland in the late historic period, with particular attention to the role of commercial use.

It was further decided to restrict examination to the counties of Perthshire and Argyllshire in the period 1650-1850. Evidence relating to the period is mainly documentary, of a type favouring the employment of case studies based on bodies of primary evidence; it was decided to pay attention specifically to examples of the commercial use of pinewood, deciduous tanbark coppice, and iron smelting.

CHAPTER TWO

ARGYLLSHIRE AND PERTHSHIRE

2.1 Introduction

The counties of Argyllshire and Perthshire lie between the latitudes of 55° and 57° north and extend in longitudinal terms from 3° to 7° 30' west. Both are among the larger Scottish counties, and together they include approximately eighteen per cent of the Scottish surface area; Argyllshire is the larger with a surface area of 3,110 square miles (8,055 sq.km.) and Perthshire occupies 2,493 square miles (6,057 sq.km.). Both counties range in altitude from sea level to more than 3,000 feet (915m.); the highest peaks in Perthshire and Argyllshire respectively are Ben Lawers at 3,984 feet (1,215m.) and Bidean nam Bian at 3,761 feet (1,147m.). The boundary between the counties crosses Rannoch Moor and follows a series of peaks which form part of the main divide between eastward and westward drainage in the Highlands.

Despite their similarity in area the counties differ strikingly in form in a way which reflects the general difference between the east and central Highlands and the west. Perthshire is compact and approximately oval, corresponding broadly in outline to the area drained by rivers of the Tay and Earn systems except in the southwest;

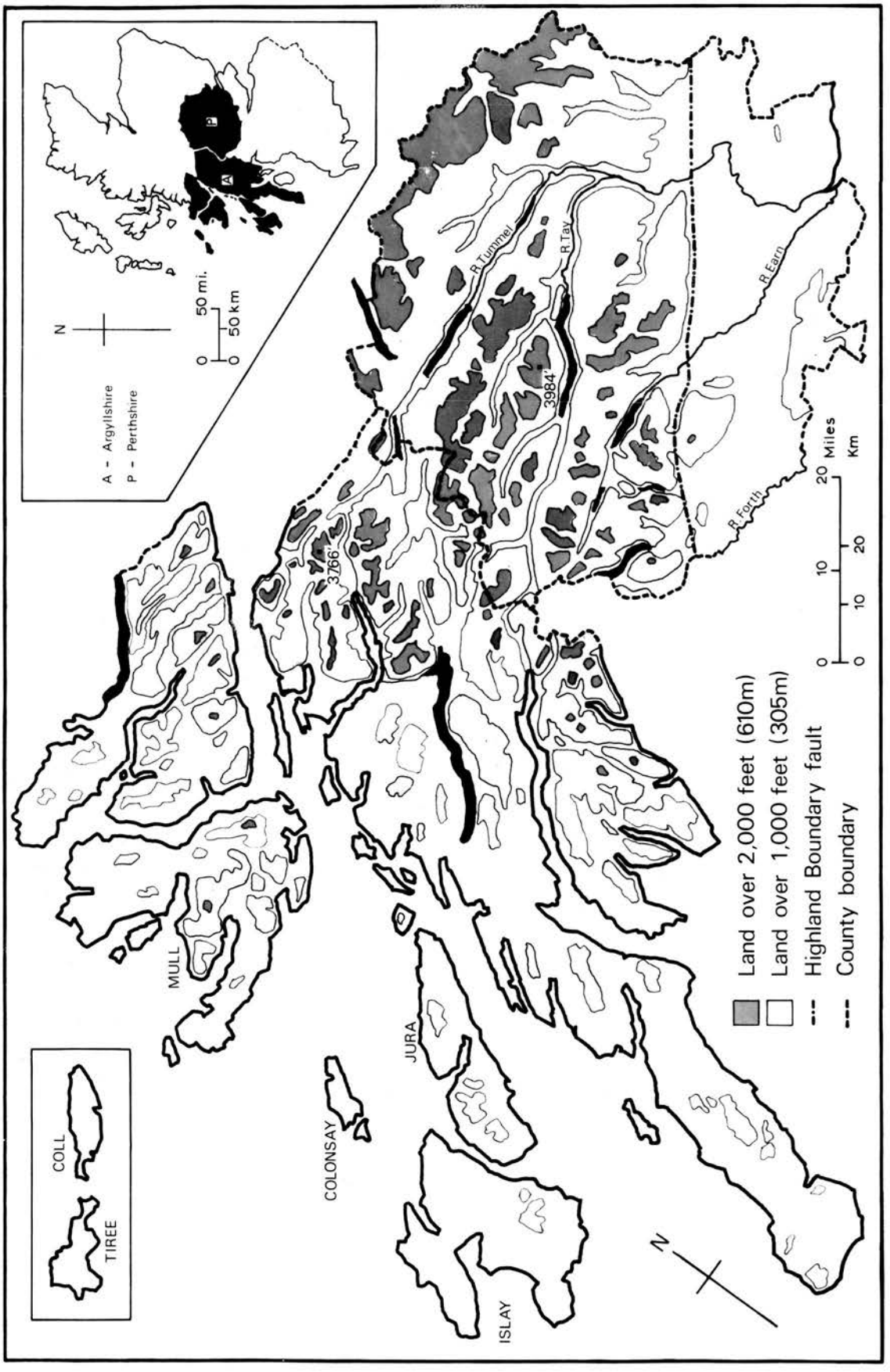


Figure 2.1 . Argyllshire and Perthshire ; physical features.

the county is landlocked and contains only a short tidal section of the lower Tay. The Highland Boundary fault runs northeast-southwest across the county; the lowland areas and minor ranges to the south and east of the fault occupy roughly forty per cent of the total area (Fig. 2.1).

Argyllshire, however, is irregular in shape and fragmented; the county includes a large number of islands, among which Mull, Jura, and Islay are the most significant. The mainland of Argyllshire is penetrated and divided by sea lochs and there is no major fluvial drainage system comparable to that of Perthshire; only a few inland areas on the eastern boundary are more than fifteen miles (24 km.) from tidal water, whereas in Perthshire the area north and west of the Boundary fault is almost entirely fifteen miles or more from the sea. Finally, there is no extensive lowland area comparable to that of southern Perthshire, and lowland is confined largely to narrow strips on the margins of water bodies (Fig. 2.1).

The terrain of Argyllshire is generally dissected and well defined, but relatively low; with the exception of isolated peaks in Mull and Jura altitudes of 2,000 feet (610m.) or more are restricted to the eastern margin and parts of the northern mainland. In Highland Perthshire terrain is largely higher and more massive; the major interfluves commonly exceed 2,000 feet, except in the southeastern section. In southern Perthshire broad valleys trend northeast-southwest, separated by low interfluves and minor

ranges. One of these ranges, the Ochils, forms a major part of the southern boundary; to the west of the Ochils the boundary is provided by the upper section of the river Forth, which meanders through an extensive carse plain (Fig.2.1).

2.2 Structure and landforms

Both counties fall within the complex geological zone of the south Highlands characterised by the presence of Precambrian metamorphic rocks of the Moine and Dalradian series; schists, quartzites and other metamorphic rocks are therefore typical of the area, although there are major igneous intrusions in north and northeast Argyllshire and in northwest Perthshire. The metamorphic zone is bounded on the south by the line of the Highland Boundary fault, which forms the northern and western margin of the complex Midland Valley syncline. Sandstones and conglomerates of Devonian age predominate in the Perthshire part of the syncline, but lavas of Lower Devonian origin are also present; similar extrusive rocks form the Lorn plateau in north Argyll (George (1965) 4-6).

Movement along the line of the Highland Boundary fault in the Devonian period emphasised the geological difference between the Highland and lowland areas; Hercynian movements later strengthened the distinction and created the Great Glen tear fault along a similar northeast-southwest axis;

the series of sub-parallel faults running through Perthshire into Argyll is probably also Hercynian, and followed the persistent northeast-southwest structural trend in the geological history of the area. There was little geological activity in the Highland area during the Tertiary period, but Mull, Ardnamurchan, and parts of Morvern were considerably modified in a phase of igneous intrusion and extrusion (George (1965) 4,22, 28-9).

There is a recognisable correspondence between geological distributions and land forms in the area, largely as a result of differential erosion of the least resistant rocks and those weakened by faulting. Thus erosion of the Devonian sandstones to the south has accentuated the line of the Highland Boundary fault, except where the more resistant conglomerates form a residual block southwest of Crieff; the only other significant relief in southern Perthshire is provided by the Devonian lavas of the Ochils and Sidlaws (Sissons (1967) 3-5). Faults have guided the orientation of several major basins like that of Loch Tay (George (1965) 33). Differential erosion has created linear patterns in the coastal forms and drainage systems of Argyllshire; this is evident especially in Knapdale, where parallel bands of epidiorite have been resistant enough to have a marked effect on major and minor topographic forms (Sissons (1967) 10,54).

The geomorphic development of the area has not been controlled entirely by structure and lithology. During

the Tertiary period erosion surfaces were formed throughout the Highlands in marine or sub-aerial conditions, transgressing over geological boundaries. These have been modified by later fluvial erosion, however, and also by the Quaternary glaciation, which has had a major effect on the landscape of the Highlands (Sissons (1967) 15-21). The overall duration of glaciation in Scotland may have been several hundred thousand years; the final major phase appears to have begun about 70,000 years ago and terminated, after a series of re-advances and retreats, about 10,000 B.C. During this period Rannoch Moor and the upland along the boundary between the two counties was consistently a centre of ice accumulation and dispersal; this is evident from the radial pattern of ice-scoured rock basins around the moor (Sissons (1967) 40-1, 50, 144-6).

One principal effect of glaciation was the deepening of existing valleys and the creation of new basins and channels now occupied by rivers or lakes. The centres of ice accumulation were closer to the west coast than the east and gradients to sea level on the west coast were therefore steeper; the deep dissection and intricate fjord coastline of Argyll may largely be attributed to glacial action (Sissons (1967) 29). Valleys with steep sides and broad shallow bases were incised into the pattern of relict erosion surfaces; corries developed on the upper slopes as minor sources of ice formation and dispersal, especially in the west Highlands. The movement of ice scoured and roughened the ground surface within the valleys and on the up-

lands, often accelerating differential erosion of the component rock types (Sissons (1967) 53-6).

Superficial deposits were removed from the bedrock of much of the area by glacial erosion, and this material was subsequently deposited by moving or decaying ice and glacial streams; there was therefore a tendency for the upper areas to be stripped, whereas valleys and lowland areas received deposits of alien provenance. Such deposits vary greatly in character, ranging from amorphous morainic mounds of unsorted coarse debris to regular terraces of fine water-sorted sands and gravels. The relative level of the sea fluctuated as a result of isostatic and eustatic adjustment, and marine transgressions in the late glacial and early post-glacial periods are marked by a sequence of raised beaches (Sissons (1967) 162-6); these have proved valuable in providing much of the limited area of flat cultivable land in many parts of Argyllshire.

2.3 Climate and soils

The climate of the British Isles is affected markedly by the proximity of the sea and the prevalence of cyclonic conditions. Maritime position reduces the range between seasonal extremes of temperature in relation to areas at comparable latitudes within large land masses; the procession of westerly cyclones over the British Isles results from the interaction of major air masses, and the varied nature of this interaction, by affecting the size, frequency, and

path of cyclones, is largely responsible for the great variability of the British climate within the limited range characteristic of maritime temperate conditions. In the Highlands the effects of these factors are modified to some extent by topography.

The sequence of westerly cyclones is the main source of precipitation in the Highlands, and it largely takes the form of orographic rain on the uplands of the west; Argyllshire therefore has a markedly higher rainfall than most parts of Scotland. With the exception of some coastal districts, mainly in the islands and the southwest, the county has more than 60 inches (1,524 mm) per annum; most of the upland has more than 100 inches (2,450 mm), and considerably higher levels are recorded on the mountains of the eastern margin. There is a perceptible rain shadow effect in Perthshire, however, and although values in the west of the county are as high as those of upland Argyllshire the river valleys and the eastern section generally have less than sixty inches. Some parts of eastern lowland Perthshire receive less than thirty inches (762 mm) per annum (OS (1967m)).

The climate of the eastern Highlands has a tendency towards continentality which is absent from Argyllshire. In January the daily mean temperature in the outer isles of Argyllshire is as high as 42°F (5.5°C), but most of Perthshire has a daily mean under 40°F (4.4°C) and temperatures under 38°F (3.3°C) are recorded in parts of the centre and east. In July the gradient is reversed and the daily mean rises from less than 58°F (14.4°C) in the outer isles to 59°F (15°C) and more in parts of

central Perthshire. The range of temperatures is therefore greater in the east; the difference between the mean daily minimum in January and the mean daily maximum in July is about 24°F (13.3°C) in the Argyllshire islands but as much as 34°F (18.8°C) in central Perthshire (MO (1952m) 34, 40).

Such data do not take into account the reduction of temperature and increased wind exposure which accompany increase in altitude; simple measurement of temperature and precipitation is also inadequate as a means of indicating the probable effects of climate on vegetation (McVean & Ratcliffe (1962) 144). It is recognised that in northwest Europe the degree of climatic oceanicity has significant effects on vegetation. In relation to continental regimes, the aspects of oceanic climates which have important effects on vegetation include not only increased precipitation and reduction in the range of temperatures but also greater atmospheric humidity, increased wind velocity, and reduced insolation; the application of an index of oceanicity based on these factors indicates that Argyllshire is indeed significantly more oceanic than Perthshire in such terms (Poore & McVean (1957) 411-13).

A sequence of climatic changes has affected the British Isles and western Europe as a whole since the last glaciation (Lamb (1965) 6-8). These changes appear to have been associated with variation in the intensity of oceanic influence; when the general atmospheric circulation intensifies the climate of northwest Europe becomes more markedly

oceanic, but weakening of the circulation is associated with extension southward and westward of the polar and continental high pressure systems and a corresponding southward diversion of the westerly belts (Lamb (1959) 311-16). The period between 1550 and 1850 appears to have been characterised by increased continentality of this type (Lamb (1965) 8); it is likely that the climate of Perthshire and perhaps inland Argyllshire was more continental than at present, although coastal Argyllshire may have been little affected.

As already noted, climate is also a major factor in the development of soils (above, 1.2). The soils of Scotland are relatively young, having developed since the last glaciation; they are very often formed on glacial deposits which are not derived from the underlying bedrock. The types of rock from which Highland soils have developed are largely acidic and base-rich material is limited in extent; soils formed from acidic material generally do not contain a large quantity of available plant nutrients, and the action of the cool wet Highland climate also contributes to the impoverishment of Highland soils. Heavy precipitation promotes the process of podsolisation, in which nutrients are leached from the upper soil horizons (McVean & Ratcliffe (1962) 161-3).

Heavy or persistent precipitation also contributes to the formation of blanket peat on plateaux and slopes too shallow to permit effective drainage; blanket peat extends vigorously during periods of intense oceanicity and there

have been two major episodes of bog formation, in the Atlantic and sub-Atlantic phases of the postglacial period (Pennington (1969) 55-7, 78-85). It has been suggested that podsolisation generally precedes the development of blanket peat on a site (Lamb (1964) 385-6); on the steeper slopes, however, podsolisation is not generally followed by bog formation. Blanket peats and soils in various stages of podsolisation are together perhaps the most characteristic and widely distributed soils in Argyllshire and upland Perthshire; impoverishment of a given type of soil may be greater in the west than in comparable conditions in the east Highlands but quantitative evidence of this is at present absent (McVean & Ratcliffe (1962) 161-3).

2.4 Vegetation and fauna

Vegetational patterns are not static; it has already been observed that postglacial climatic changes have been accompanied by vegetational change, and modern vegetation has also been modified by anthropogenic factors (above, 1.3). At present the vegetation of Argyllshire consists largely of a mosaic of grassland and bog communities, the distribution of which may be explained primarily in terms of precipitation and surface drainage and to a lesser extent by variation in altitude and the base status of soil. Communities of grasses and dwarf shrubs are common on ombrogenous or blanket peats and on the soligenous peats formed where surface water is concentrated by topography; grass

heath communities dominated by grasses, sedges and rushes are generally found on the steeper and better-drained slopes (McVean & Ratcliffe (1962) 52-65, 107-13, McVean (1964c) 575-6). The dissected terrain of the county provides a fragmented pattern of environments for vegetation, which is consequently not often homogeneous over extensive areas.

Grassland communities are not absent from upland Perthshire, and in the western part of the county grass heaths like those of eastern Argyllshire are common. The drier nature of the area is reflected, however, in the general predominance of heather (Calluna vulgaris). Heather moor, in which this species is invariably dominant among the component dwarf shrubs, is extensive on the better-drained sites up to 1,500 feet (457 m); heather is commonly co-dominant with deer hair sedge (Tricophorum caespitosum) on shallow blanket peats at higher altitudes, and it shares dominance with cotton grass (Eriophorum vaginatum) on wetter sites at altitudes up to 3,000 feet (914 m) (McVean & Ratcliffe (1962) 28-9, 103-7, McVean (1964c) 568-72). The higher parts of the ranges of south Perthshire also carry grass heath and heath communities.

Most of the area of lowland Perthshire consists of cultivated land and modified grassland, and this is true also of the valleys of upland Perthshire and coastal areas in Argyllshire (OS. (1953m)). The upland communities described above have also largely been created by human action. In the absence of man grass heaths are likely to

have occurred only at high altitudes, and those at present found below 2,500 feet (763 m) are almost certainly anthropogenic in origin. Heather moor and other forms of dwarf shrub heath are also likely to be anthropogenic when found below the tree-line (McVean & Ratcliffe (1962) 28,51,109). Grazing has undoubtedly been very significant in the creation of these modified communities but the systematic burning associated with sheep farming and grouse management has also been important; it is apparent that continued burning perpetuates heather moor in the east but tends to favour replacement by grassland communities in the wetter areas of the west (McVean & Lockie (1969) 36-9).

It is evident from Figures 2.2 and 2.3 that woodland at one time covered many of the sites now occupied by grass heath, dwarf shrub heath, and bog communities, and Figures 2.4 and 2.5 demonstrate that by 1750 woodland was very restricted in extent in both counties (Fig. 2.2, Fig. 2.3, Fig. 2.4, Fig. 2.5); it is therefore probable that communities comparable to those of the present were in existence during the period in question, although certainty is not possible in the absence of detailed contemporary descriptions and analyses. Before the advent of extensive sheep-farming heather moor may have been more widespread in Argyllshire than at present, especially if climatic conditions were more continental than in the modern period; it is apparent that sheep management rapidly converted heather moorland to grassland in at least some parts of

southern Argyllshire (below, 4.6).

Figures 2.2 and 2.3 are based on a map prepared by McVean and Ratcliffe, largely on a basis of palynological data and the present distribution of woodland and relict material in peat, as a conjectural reconstruction of the woodland of Scotland at the present climatic period, about 500 B.C. It indicates that tree species were dominant through most of the area and suggests that certain altitudinal relationships existed. Woodland dominated by oak (Quercus petraea and Q.robur) occupied most of the lowland in both counties, giving way to Scots pine (Pinus sylvestris) at approximately 600 feet (183 m) in Perthshire and rather lower altitudes in Argyllshire; near the upper limit of tree growth pinewood was succeeded by woodland dominated by birch (Betula pubescens and B.verrucosa). In the more oceanic parts of Argyllshire pine was not present and birchwood succeeded oak directly, becoming extensive in area and replacing oakwood entirely in the extreme west and southwest (Fig. 2.2, Fig. 2.3).

The present distribution of woodland is very different, consisting essentially of intermittent linear patterns. In Perthshire semi-natural woodland is confined largely to the lines of valleys, following the margins of lochs and the lower slopes of river valley sides; bottomland is not generally wooded, although trees may occupy raised sites on the valley floor and lines of trees of water-tolerant species may border the river. There is a comparable dis-

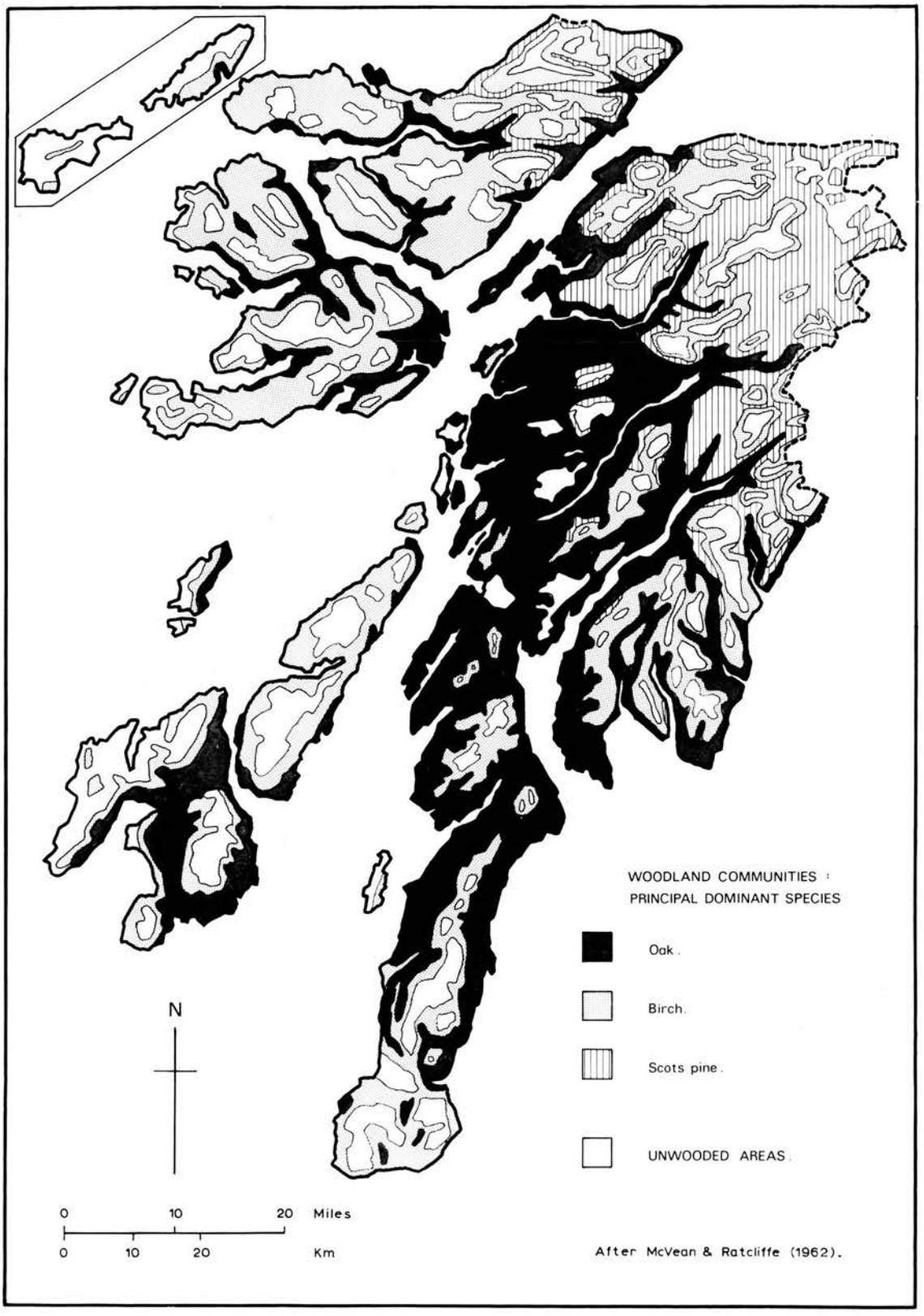


Figure 2.2 . Reconstruction of the vegetation of Argyllshire before human colonisation .

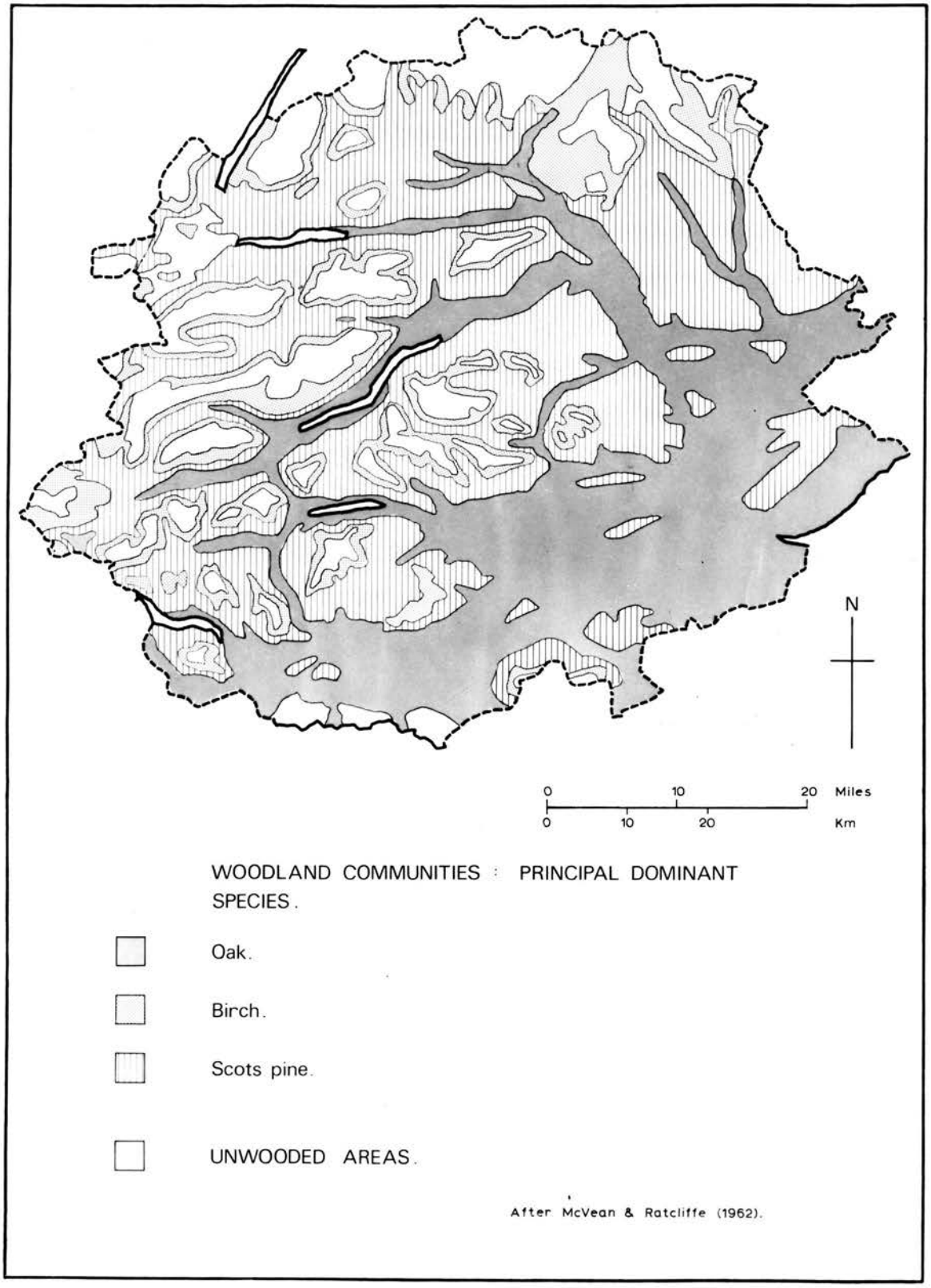


Figure 2.3. Reconstruction of the vegetation of Perthshire before human colonisation.

tribution in Argyllshire, with the addition of woodland on some of the more sheltered sections of the indented oceanic coastline. Although woodland is remarkably persistent on steep slopes near the valley bottoms, little survives on exposed gentle upland slopes in either county and it only intermittently reaches a level which may locally represent the tree-line (above, 1.3).

Present distributions were utilised by McVean and Ratcliffe in the preparation of the map described above. It might therefore reasonably be expected that the species composition of the surviving remnants would reflect that of the reconstruction. In such a case oak would predominate among the woods of lower levels; some fragments of pinewood might survive, but woodland dominated by birch would be likely to remain only in western Argyllshire, where it had previously occurred at relatively low altitudes (Fig. 2.2, Fig. 2.3). As shall be seen later, surviving pinewoods are located within the areal and altitudinal range suggested by the model (below, 5.7). The distribution of deciduous species does not correspond closely to that which has been predicted; a limited number of woods with oak dominance remain, but birch is the characteristic tree of surviving Highland deciduous woodland (Steven & Carlisle (1959) 67).

As shall be seen later, oakwood was extensive enough in Perthshire and Argyllshire during the period in question to support an extensive trade in tanbark; it is therefore evident that there has been a decline in the status of oak,

and possible explanations for this shall be discussed later (below, 4.8). The birch-dominated woodland which survives at low levels may represent the extension of a subsidiary birch component which became dominant when oak declined; alternatively birch may have invaded the sites of moribund oakwood. In Scottish conditions birch is primarily a pioneer species rather than a climax community dominant, seeding readily and colonising open and unwooded sites which are later yielded to oak, pine, or other climax dominants; the present prominence of birch may be due to the action of environmental or anthropogenic factors which prevent succession by the climax-forming species (McVean & Ratcliffe (1962) 19-20).

The ecology of pinewood shall be discussed more fully later (below, 5.2). It may be noted that in the Highlands Scots pine, the only native British conifer, is generally the dominant species when it is present in woodland. Almost all Highland pinewoods contain an admixture of deciduous trees, but the intermittent mass regeneration which appears to be characteristic of the species suggests that stable mixed communities do not exist (Steven & Carlisle (1959) 69-70, McVean & Ratcliffe (1962) 14-15). The species prefers continental conditions but tolerates heavy precipitation, although it generally requires light and freely-drained soils (Carlisle & Brown (1968) 275). The fragments of pinewood which survive in Argyllshire are located in the parts of the county where precipitation is greatest; it is

therefore evident that other aspects of the oceanic climate are responsible for the absence of the species from the southern and western parts of the county (McVean (1964a) 145-6).

A number of species apart from the birches and oaks occur as trees or large shrubs in deciduous woodland. These include alder (Alnus glutinosa), rowan or mountain ash (Sorbus aucuparia), a number of species of willow (Salix spp.), aspen (Populus tremula), ash (Fraxinus excelsior), wych elm (Ulmus glabra), bird cherry (Prunus padus), holly (Ilex aquifolium), hazel (Corylus avellana), hawthorn (Crataegus monogyna), and juniper (Juniperus communis). The distribution of many of these species is irregular and their relative importance is very variable, but some may locally achieve dominance (McVean & Ratcliffe (1962) 20-4). A number of them are associated with specific site conditions; especially important in this regard is alder, which is very common on moist sites within and outside woodland dominated by other species (McVean (1956) 325-6).

Attention will generally be concentrated on Argyllshire and the Highland part of Perthshire. Early maps indicate that by the seventeenth century woodland in lowland Perthshire consisted largely of regular plantations and groups of planted trees around settlements (NLS (M) Case 8A.2, 2, 5, BM(M) K.Top.48.44).

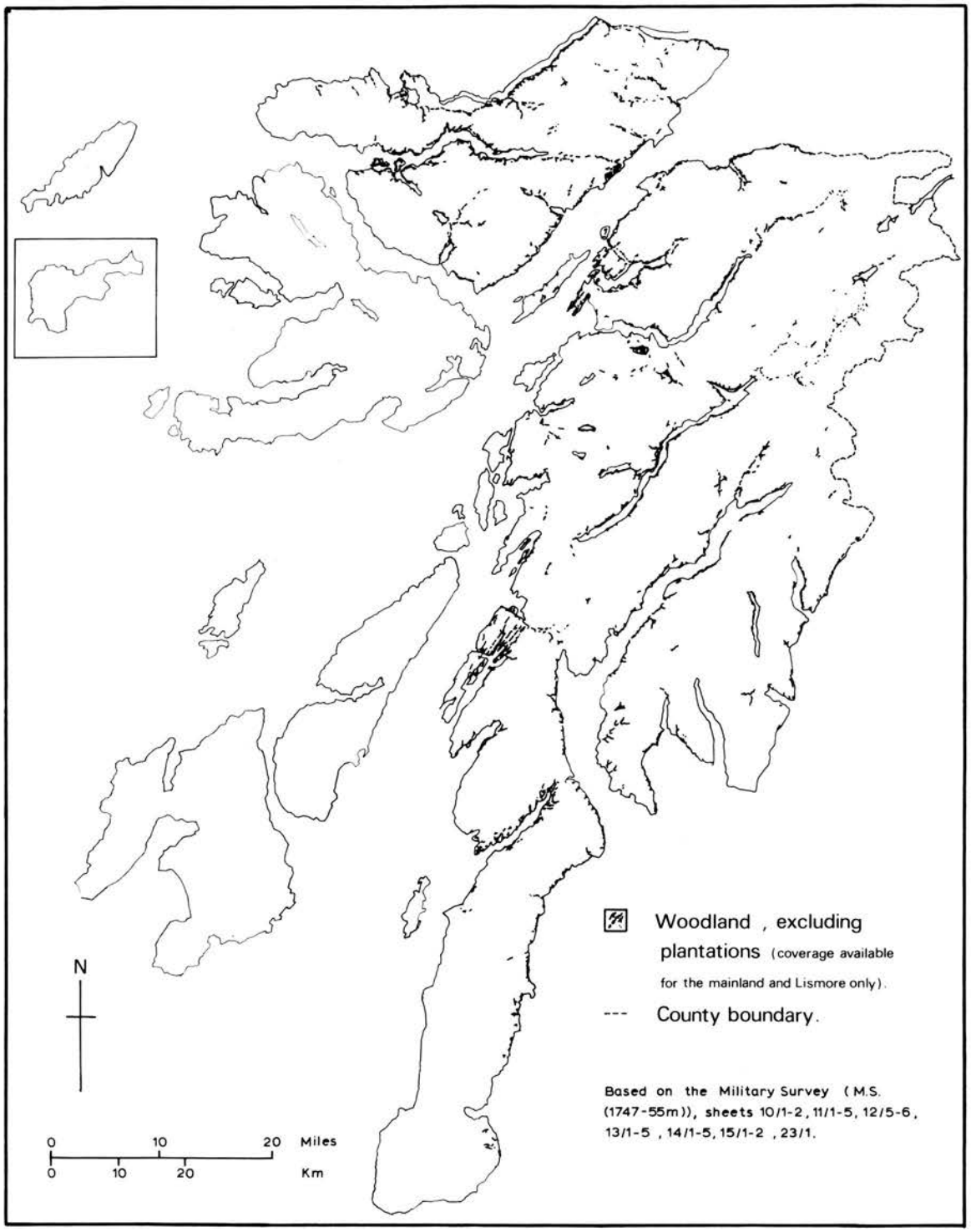


Figure 2.4 Woodland in Argyllshire , 1750.

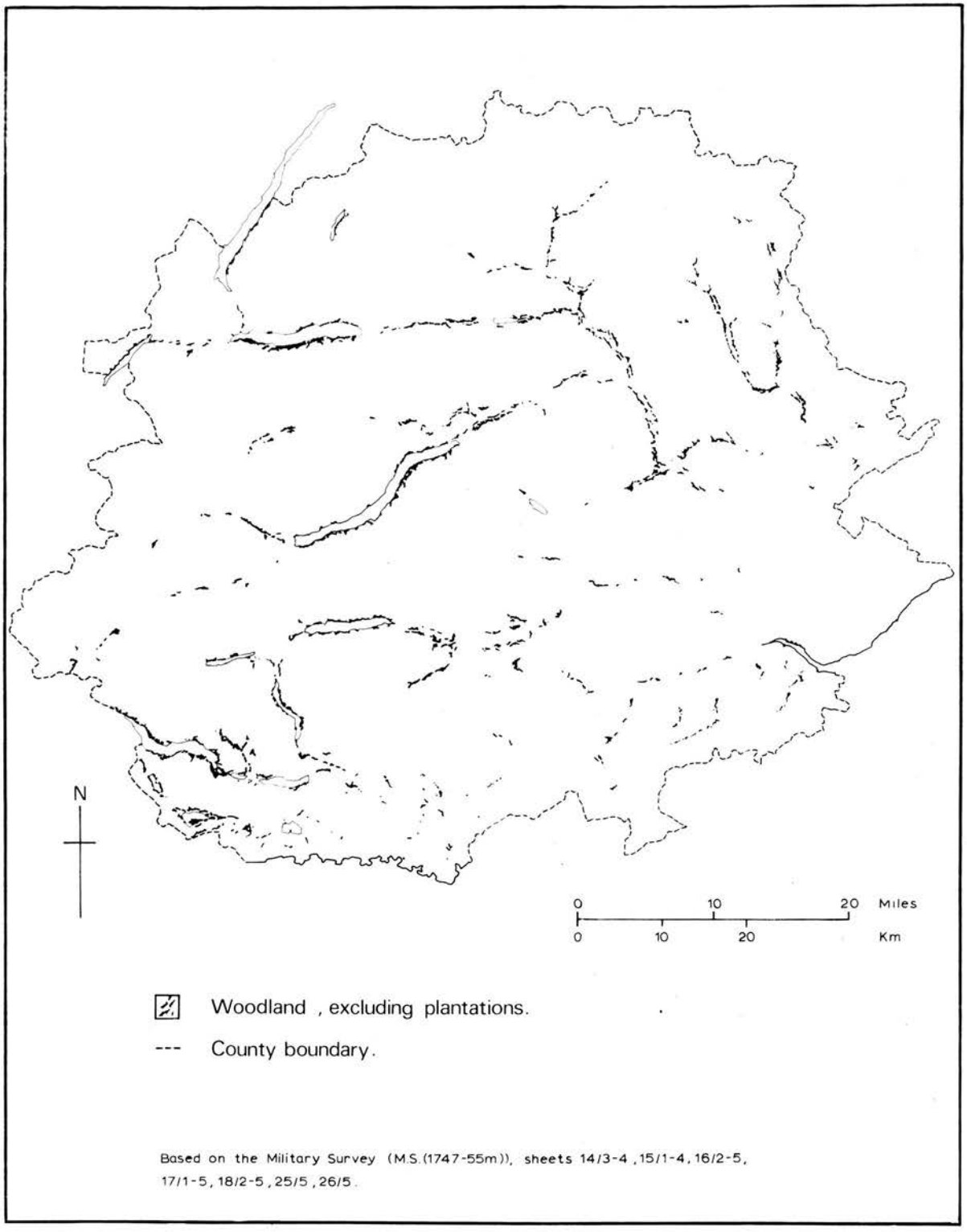


Figure 2.5 . Woodland in Perthshire , 1750.

Such a pattern is also evident from Figures 2.4 and 2.5, which indicate the distribution of woodland in Perthshire and the mainland of Argyllshire about the year 1750. The form of the Military Survey does not invariably permit distinction between semi-natural and planted woodland; only woods regular enough in form to indicate clearly an origin as plantation and clusters of trees round settlements have been excluded from these figures, which may therefore over-estimate the extent of semi-natural woodland in some districts. It is nevertheless evident that woodland was then distributed in discontinuous linear patterns throughout both counties, as it is at present (Fig. 2.4, Fig. 2.5).

It cannot be assumed that species composition has remained constant. As shall be seen later, the location of pinewood has changed relatively little but internal composition may have altered considerably during the historic period (McVean (1963a) 684, below, 5.2). It has already been observed that much of the woodland of the lower part of the two counties has probably made a transition from oak to birch dominance, and that this process may have been active during the period in question. Documentary evidence cannot be expected to provide detailed and accurate information about the species composition of woodland, but may

indicate the principal species found on a certain site at a certain time. Examination of documentary evidence may therefore indicate whether dominance has in fact changed in areas which are now birchwood.

It may finally be noted that some terminological change has taken place. Contemporary records frequently used terms which are now obsolete or confined to dialect use; thus alder was described as 'arn' or 'aller' and the word 'saugh' was used to name one or more of the species of willow (Edlin (1962) 232-3). Scots pine was almost invariably described as 'fir' or 'Scots fir', terms which are undesirable in suggesting that the tree belongs to the genus Abies. Such terms shall therefore be replaced throughout by those currently in use, except in direct quotations and in certain cases like the term 'candle fir', where no modern and concise equivalent exists.

Little is known about the distribution and number of feral grazing animals during this period. Those most likely to have caused serious damage to woodland are red and roe deer, both of which were present in both counties, although deer forest of the present type evolved especially after 1850 and in the northern Highlands. Information about populations of red deer is still incomplete and knowledge about roe deer stocks is even less adequate (McVean & Lockie (1969) 66, 73, 78, Mather (1972) 39-40); the relative importance of deer

in Argyllshire and Perthshire before the institution of controlled deer forest cannot be certain. The relative significance of domesticated and feral stocks has already been noted (above, 1.3); red deer in particular seem to have become a serious danger to woodland only since regular management of deer as a game stock was introduced.

Smaller animals which more recently have caused serious or persistent damage to woodland appeared late in the period in both counties. Rabbits became common as feralised animals in Scotland only in the nineteenth century, and populations expanded irregularly in both counties before 1850 (Ritchie (1921) 249-52, Anderson (1967) V.2, 290-3). The red squirrel was re-introduced shortly before 1800 and numbers expanded in a similar way, but the grey squirrel was introduced only after 1890 (Ritchie (1921) 289-90, Anderson (1967) V.2, 290). The destruction of predators to protect grouse and other small game may have allowed these species to thrive, but the numerical relationship between predatory animals and prey in the Highlands remains uncertain (McVean & Lockie (1969) 96-7).

2.5 Economic and social patterns

In the earlier part of the period the economy and society of Argyllshire and Perthshire was aristocratic and

militaristic; the mass of the population held land from hereditary leaders in exchange for loyalty and military service as well as rent. Such a system was common to the Highlands and also to many other parts of Scotland as late as the sixteenth century; the social organisation of the Highlands was distinctive partly in surviving when lowland nobles no longer maintained private armies, and partly in emphasising the importance of kinship and clan loyalty. A clan was basically a group tracing descent from a common ancestor and owing loyalty to a chief, generally a member of the most direct line of descent. The need for able-bodied men discouraged application of rigorous genealogical standards, however, and the clans frequently assimilated men who could not claim membership on the basis of kinship.

Clans were also flexible in territorial terms; some chiefs did not hold land and the clansmen of others were widely dispersed. Loyalties to land and clan therefore did not invariably coincide, and a man might owe service as a tenant to one chief and as a clan member to another (Smout (1969) 44-7). Clan organisation did not therefore provide a uniform and inflexible social structure, but it perpetuated a society in which economic considerations were not infrequently subsidiary to social demands. The abortive rebellion of 1745 largely destroyed the power of the clans as military and political forces, but the survival of the loyalties on which clan organisation was founded

presented persistent obstacles to later attempts to rationalise the economy of the Highlands (Smout (1969) 140-1).

Highland proprietors were generally chiefs or members of the main lineage of their clans, and paternalism characterised relationships with their tenants and dependants. Thus proprietors often offered assistance to their tenants when they were affected by crop failure and other difficulties; few tenants had formal evidence of tenure, but a man who understood and followed his roles as clansman and tenant was unlikely to face eviction (Gray (1957) 20-2, 53-4, Smout (1969) 140-1). Practical considerations underlay these manifestations of benevolence. Eviction removed any possibility of recovering arrears, and the material poverty of many tenants made prosecution equally valueless; both actions were likely to jeopardise the goodwill and trust of the remaining tenants, on whose cooperation social stability depended.

Provisions formed a significant proportion of the rent paid by most tenants, and the quantity of cash paid depended largely on the ability of the tenant to sell his produce to markets outside the Highlands (Smout (1969) 139-40). On many estates rent was paid not directly to the proprietor but to tacksmen, intermediary large tenants who usually farmed little of their land and lived mainly on the balance between their own rent and that paid to them by the working tenants of the land; tacksmen generally owed their privileged position to close relationship to the

proprietor (Gray (1957) 12-13, Smout (1969) 138). The fundamental unit of tenure was the joint farm; such farms were divided into a number of more or less equal holdings, and the number of these held by a tenant determined his share of the benefits and duties of the farm as a whole.

Joint tenancy was valuable in facilitating the control of communal grazing and the organisation of cooperative labour, both in cultivation and in performance of services demanded by the proprietor as a condition of tenure; livestock and produce remained the property of individuals (Gray (1957) 18-21), Gailey (1963) 105-6). It also supported the large rural population regarded as desirable for military purposes and inevitable in the absence of alternative forms of employment; the land area was therefore minutely divided and the tenant holdings of ten acres (4.0 ha.) available in parts of Perthshire and Argyllshire were large in relation to those of other Highland counties (Gray (1957) 21-3, Smout (1969) 338-9). Survival was generally possible but poor harvests or stock diseases had disastrous effects on such communities.

No reliable information is available about population in the first half of the period, but Webster's census of 1755 indicates totals of 66,000 and 120,000 in Argyllshire and Perthshire respectively (Kyd, ed. (1952) 33-5, 42-6). This suggests that the overall mean densities in the two counties were 21 per square mile (54 p.sq.km) and 48 per square mile (124 p.sq.km) respectively, although the mean

density in Perthshire was reduced to about 25 per square mile (65 p.sq.km) if the lowland parishes were excluded. At present totals in both counties are similar to those of 1755, although it is probable that the burghs and lowland areas are now proportionately much more significant; in 1961 the populations of Argyllshire and Perthshire respectively were 59,345 and 127,018 (Anon (1961) 10,13). The highest population densities and totals were reached in the intervening period; growth continued after 1755 and most parishes in Argyllshire and Highland Perthshire attained their greatest known populations between 1801 and 1831 (O'Dell & Walton (1962) 158, Smout (1969) 258-61).

With the exception of lowland Perthshire the two counties contain little good land, and most can be regarded as being no better than rough grazing (OS (1945m)). The economy of the Highlands has therefore been consistently pastoral in emphasis, and in the traditional economy the characteristic form was subsistence pastoralism accompanied by cultivation of limited areas. Livestock provided tenants with meat and dairy produce, but the cultivated areas available were in many cases insufficient to provide an adequate supplement; in the middle of the eighteenth century the tenants of many Highland districts found it necessary to import grain from the lowlands in most years, and such a practice appears to have been established in Argyllshire as early as the sixteenth century (Gray (1957) 42-4, Symon (1959) 87).

Cultivation nevertheless had some significance. The principal crops grown were oats and a form of barley known as bere; practice varied from district to district but the Highlands shared with lowland Scotland a system in which limited areas of good land were heavily manured and cropped annually or in the majority of years. This 'infield' was supplemented by a more extensive area known as outfield, which was roughly divided into sections cropped in succession with or without manure; in some cases no infield was employed (Gray (1957) 32-3). In many cases the area of cultivable land could be extended only by utilisation of the steeper slopes of the valley sides; the head dyke, which marks the approximate upper limit of outfield cultivation, reaches altitudes over 800 feet (244 m) in parts of Perthshire (Robertson (1949) 10-12).

Much of the area which provided an environment suitable for the survival of woodland was therefore regularly or intermittently cropped; the rarity of enclosures made it necessary to keep grazing animals away from growing crops, and as shall be seen later communal seasonal movement of livestock was characteristic of Highland pastoralism (below, 4.2). Cattle were the most important part of the stock, providing food, a regular cash income, and a form of capital for use in emergencies; tenants were able to sell animals to drovers for disposal in the markets of England and lowland Scotland. A trade of this kind was established in Argyllshire by the sixteenth century and grew steadily; by 1725 the town of Crieff in Perthshire

was the principal market at which southern merchants bought Highland store cattle (Gray (1957) 37-8, Symon (1959) 87, 116-17).

As long as the traditional economy survived without substantial modification the Highlands had little contact with the rest of Scotland. Trade was confined to the import of necessary foodstuffs and the export of primary produce; cattle were the principal export from the southern Highland counties, but both counties also produced skins and hides and the fisheries of southern Argyllshire served the Glasgow market (Gray (1957) 15, 119-20, below, 4.3). Internal trade was also rudimentary; concentrations of population larger than the clachans associated with joint farms were almost entirely absent, communications were poor, and in the absence of a merchant class trade was generally in the hands of the proprietors and tacksmen (Gray (1957) 17-18).

A major obstacle to the development of a more active trade was the general distrust and fear of Highlanders among the inhabitants of lowland Scotland and other parts of Great Britain. As early as the fourteenth century the Highlanders were regarded as wild, barbaric, and alien in customs to the rest of Scotland; mutual hostility was perhaps established and certainly exacerbated by the linguistic division between the Gaelic-speaking Highlands and the lowlands (Smout (1969) 42-4). At the beginning of the eighteenth century travellers continued to describe in

vivid detail the size of the armed bands lurking in Highland woods and the relish with which the Highlanders regularly pillaged the adjoining parts of the lowlands (Brown, ed. (1892) 29, Smout (1969) 222). However exaggerated such accounts may be, they indicate that conditions were not favourable for stable and extensive trade.

Few merchants ventured into the Highlands and much of the trade of the region took place in the towns of the Highland margins. The city of Perth and the smaller burghs of Perthshire not only had local market functions in the more fertile districts of southern Perthshire but were centres in which goods from the Highlands were sold and in some cases processed (Garnett (1800) V.2, 98-105, Allardyce, ed. (1888) V.2, 198, Smout (1963) 3). Southern Perthshire was in many ways a lowland area in character but some aspects of Highland culture were present, and Gaelic apparently remained in use in some parts in the early eighteenth century (below, 9.1). Argyllshire lacked a populated rural margin, and coastal shipping to the ports of the upper Clyde appears to have been the main mechanism of trade.

Throughout the period members of Highland landowning families travelled widely outside the region, especially on military service, and became aware of the discrepancy between their own domestic standard of living and that of their social equivalents in other areas (Gray (1957) 13-15). The rents of Highland estates were low and not paid entirely in cash; a cash income large enough to support

higher standards could be obtained if agriculture was radically changed and put on an economic footing, or if other resources were made available for sale in bulk. The first approach was socially unacceptable, but there is evidence that the second was employed on a limited scale in the early eighteenth century (below, 5.4, 8.2). Economic change was in progress after the unsuccessful rising of 1715, and radical change followed the crushing of the rebellion of 1745.

Destruction of the paramilitary basis of Highland society created the possibility of social and economic reorganisation, and after 1745 ownership passed in many cases to proprietors who were less willing than their predecessors to maintain traditional society at the expense of efficiency and give precedence to the requirements of their overcrowded tenantries; a number of estates came under the control of a commission for the management of the annexed estates. The emphatic defeat of 1746 and renewed military occupation also indicated to entrepreneurs that the exploitation of Highland resources would now be considerably less hazardous (Smout (1969) 343-5). In the century after 1750 there were repeated attempts to reform the Highland agricultural economy and to profit from resources which previously had been inaccessible (Youngson (1973) 120-60).

Primary production remained the dominant aspect of the Highland economy. The sale of black cattle continued

to expand and reached a peak during the Napoleonic Wars at the end of the eighteenth century; fishery made irregular progress in Argyllshire but was controlled mainly by lowland merchants (Campbell (1971) 36, 170-2). The landowners of northwest Argyll were also able to participate in the brief boom in the harvesting of kelp for soap and glass production in the late eighteenth and early nineteenth centuries (Gray (1957) 125-7). The earliest experiments in extensive sheep-farming in the Highlands took place in Perthshire and Argyllshire, and sheep-farming was relatively soon extensive in both counties, although western Argyllshire was affected only after 1800 (Gray (1957) 87-8).

In the late eighteenth and early nineteenth centuries the agriculture of Scotland was greatly modified by the systematic improvements in technique which had previously affected only the lands of the more enlightened proprietors (Hamilton (1963) 70-2). Southern Perthshire was affected early and the agriculture of Highland Perthshire was extensively improved by 1850, but improvement remained intermittent in Argyllshire (Gray (1957) 80-2); little land good enough to justify the capital outlay of improvement was available on many estates and land could profitably be leased as sheepwalk without expensive preparation. The Highland parts of the counties were more conspicuously affected by the associated fashion for plantation; major landowners like the fourth Duke of Atholl planted extensively, and smaller proprietors planted proportionately in Perthshire and to a lesser extent in Argyllshire (Anderson

(1967) V.1, 545-54).

Modification of the economic base was not followed by immediate social transformation. Sheep-farming was the major agricultural innovation in both counties and was not compatible with the continuation of traditional pastoralism; few small tenants had the ability or resources to take an active part in this development, but proprietors were in many cases unwilling or unable to undertake extensive programmes of resettlement or eviction. Domestic industry promised to be a suitable form of alternative employment but was seldom successful (Gray (1957) 61-4, 94, Smout (1969) 346-7). The arrival of sheep was therefore associated with depopulation in some districts in both counties but in other parts large tenant populations remained on holdings severely curtailed by the extension of sheep-farming (Gray (1957) 97-9); this would not have been possible without adoption of the potato as a high-yielding food crop, and the potato crop failures of the 1840s had disastrous effects on tenant populations (Symon (1959) 370-4).

Despite the radical economic and social changes of the preceding century, Argyllshire and Perthshire remained in 1850 essentially centres of primary production; domestic and factory industry was still confined largely to the lowland part of Perthshire and a few coastal areas in Argyllshire, especially those most accessible to Glasgow. Both counties escaped the worst of the social hardships which affected the Highlands in the century after 1750, however,

although Argyllshire seems to have lagged behind Perthshire in economic and social development. This social advantage may in part be due to the continued interest in tenant welfare shown by major proprietors like the successive dukes of Argyll and earls of Breadalbane. It is perhaps significant, however, that both counties were closer to alternative sources of employment than most of the Highland area; the new industrial opportunities offered by lowland Perthshire and the southwestern Highland margin appear to have drawn a steady stream of migrants from the adjacent Highland areas and provided an alternative to rural overcrowding (Gray (1957) 64-6).

2.6 Summary

The counties of Perthshire and Argyllshire form part of the southern Scottish Highlands; southern Perthshire is structurally and morphologically part of the Scottish Midland Valley. The counties are similar in geological terms but the differential action of climatic factors has created substantial distinctions in geomorphic form. The climate of Argyllshire is markedly more oceanic than that of Perthshire.

Climatic differences are reflected to a lesser extent in vegetational patterns. Heath and bog communities are typical of both counties. Woodland is at present intermittent in distribution and limited in extent; a comparable pattern existed in 1750 but species composition may have

been different.

During the period 1650-1850 the economy of the two counties was primarily pastoral. Before 1750 the characteristic form was a type of subsistence pastoralism; Highland areas were distinct from other parts of Scotland in socio-economic terms and resistant to change. In the following century the homogeneity of this pattern was destroyed and economic modifications superimposed on the remnants, although primary production and especially pastoralism remained dominant.

CHAPTER THREE

NON-COMMERCIAL USES OF WOODLAND PRODUCE

3.1 Introduction

The limitations of Highland resources emphasised the value of timber and woodland produce. There was no domestic tradition of pottery production or iron smelting in most Highland districts (Grant (1961) 178, below, 10.3); wood or other materials were therefore substituted in a large number of cases. Iron was an expensive import used only for certain parts of utensils, hooks, needles, pots and a few other items for which metal proved indispensable. Referring to the 1720s, Burt observed that the parts of implements which in other areas would be made of iron were partly or entirely wooden in some parts of the Highlands (Burt (1754) V.2, 122-3).

In Argyllshire and northern Perthshire as in other Highland areas the absence of large villages and towns, the poverty of most of the population, and the difficulty of importing cheaply either raw materials or finished goods ensured that the inhabitants remained largely self-sufficient, Local woodland produce was therefore important among Highland resources; it is of some value to examine the ownership of this resource and the ways in which woodland produce

was used. Documentary evidence about material culture is sparse and fragmentary, and it has been found necessary in some instances to supplement information relating directly to Perthshire and Argyllshire with evidence from other Highland regions.

3.2 Ownership and the framework of control

In Scotland the ownership of woodland outside royal forest was tied to the ownership of land, and tenants had no legal right to the use of the produce. This principle was established by the fifteenth century (Anderson (1967) V.1, 274); the law as formally stated in the nineteenth century reserved all woodland to the landowner, including any trees planted by tenants. This fact was implicit in conventional leases and even a lease 'with woods' allowed the lessee to cut timber only for the construction and repair of farm buildings; the tenant was liable in damages and statutory penalties for any damage to wood on his holding (Bell (1838) 517, 635, 825).

The law of Scotland was applicable to the Highlands; there is therefore no foundation in law for the belief that woodland was part of a set of resources treated as common property before the reorganisation of Highland society in the eighteenth century. Nor was the region divided into traditional clan territories held by chiefs in benevolent trusteeship for their clansmen; by the late middle ages feudal charters giving their possessors a great degree of

control over lands and vassals were universal in the Highlands (Smout (1969) 45). The use of woodland by tenants was a privilege, although often so long established in local custom that it could not easily be withdrawn. In an assessment for teinds in 1627 the heritors of Dull parish in north Perthshire classified woodland with peat bog, grazings, shielings and other resources which were bestowed on their tenants as 'benefits and commodities' independent of the lease of land (MacGrigor, ed. (1835) 155).

It is possible that chiefs did not exercise their authority as landowners, but there is little contemporary evidence that within the Highland community the legal distinction between right and privilege was disregarded to the extent that tenants could believe themselves entitled to the use of land and resources. Chiefs may not have been strict in controlling the use of resources, but the belief that resources were held in common appears to have its real genesis in a nostalgic view of an ideal past held in the nineteenth century by inhabitants and visitors to the Highlands. Only by the indirect means of servitudes did the use of wood by tenants approach the status of a right.

Possession of a servitude allowed a proprietor to perform certain acts on the lands of another proprietor which otherwise would have been illegal (Bell (1838) 754). The use of a servitude could be extended to tenants; a servitude established in 1686 over Kingairloch in Morvern allowed tenants in Lismore to collect six large boat loads of any

timber except rowan and straight hazel annually, and was redeemed only about 1844 (NSAS (1845) V.7 (Argyll), 237). Possession of such a servitude was of some value; in 1801 an advertisement of lands for sale on Loch Awe in Argyllshire emphasised the existence of a servitude for house timbers over an adjacent estate (Anderson (1967) V.2, 54). They were also the cause of disagreement; a celebrated dispute carried on from 1760 to 1782 with the earl of Fife and Farquharson of Invercauld as principal parties concerned the alleged abuse of a servitude over the pinewoods of the earldom of Mar (Michie, ed. (1901) 136-94).

The commonties of Scotland differed from English commons in being shared among landowners rather than the population as a whole (Adams (1967) 27); none of the woodland of Scotland was therefore subject to rights of common comparable to those of England, and the use of woodland could be controlled by national and local legislation (Edlin (1956) 97-8). The earliest recorded controls are the laws of the royal forests, which appear to have been codified before 1400; they applied directly only to royal forest, most of which was alienated before 1707 (Anderson (1967) V.1, 155, 433). Penalties were specified for illicit cutting of greenwood, but most of the forest laws related primarily to hunting and pasturage. It is probable that the pasture regulations were designed to preserve grazing for certain uses rather than to protect woodland in the forests; forest was commonly used both as a deer reserve and for the grazing of stud mares (APS V.1 (1844) 688-92).

From 1424 until Union in 1707 the parliaments of Scotland passed acts which affected both royal forest and private woodland. One series consisted of attempts to regulate grazing and to prevent the cutting of greenwood, the peeling of bark, and the destruction of growing timber; another group included attempts to encourage or compel planting by proprietors and tenants. Although statute required that young plantations should be protected and managed in certain ways, semi-natural wood was protected only by general restrictions on damage, bark-peeling and cutting of greenwood; greenwood is most satisfactorily defined as including living woodland trees and their timber and excluding dead branches and fallen or lying dead wood (APS V.1 (1844) 689).

The use of dead wood was allowed at times when greenwood was protected. Such timber was a perquisite of forestry; in 1609 the forester of Torwood in Stirlingshire was granted the fallen wood with the bark and boughs of trees which fell or were cut in the wood, and in a dispute over the forest of Mamlorne in 1733 it was testified that as hereditary keeper the earl of Breadalbane had the sole right to use timber but could take only dead wood (Anderson (1967) V.1, 335, 496). Similar customs were found outside royal forest; as early as 1250 a grant of Perthshire woodland allowed Lindores Abbey as much dead wood or dry timber as required for fuel (Dowden, ed. (1903) 80). There is also evidence as late as 1800 of a practice comparable to the English common of estovers, the use of dead wood

detachable with a blunt instrument (Edlin (1956) 97-8, below, 3.5).

It is very likely that national statute was ineffective in itself; the central judicial system of Scotland reached many districts only in the form of infrequent circuit courts or justice ayres, and was especially ineffective in the Highlands. The frequent modification and progressively greater severity of these acts indicates that they were not successful. The preamble to the act of 1503 concerning greenwood cutting claimed that the wood of Scotland was utterly destroyed, and penalties were repeatedly increased until greenwood cutting became a capital offence in 1587 (APS V.2 (1814) 242, 251, 343, APS V.3 (1814) 34, 39, 460). Control was later relaxed; the general act of 1661 retained the provisions of older statutes but commuted their penalties into pecuniary terms (Bell (1838) 635).

Statute may have been more effective in providing a framework for the procedure of local courts. There were many courts of regality with a wide competence; at a lower level the holding of land as a barony direct from the Crown carried a civil and criminal jurisdiction effective after 1595 over all inhabitants of barony lands and competent to deal with woodland offences. Surviving baron court records show that national statute was combined with ordinances designed to meet specifically local conditions; thus in 1621 the Glen Orchy court confined muirburn to the period designated by law but added regulations relating to local

terrain (Innes, ed. (1855) 352). Such courts were the main legal powers in many minor matters through much of Scotland until 1747, when the higher heritable jurisdictions were abolished and the competence of courts of barony was greatly reduced (Bell (1838) 103-4, 707-8).

Baron courts controlled the use of woodland in accordance with national statute and local usage. There was a general emphasis on the prohibition of damage within the broad terms set by statute and few ordinances were related to the positive management and improvement of existing woodland, although the restriction of muirburn and grazing was a form of conservation. The nature of court records indicates a deeply conservative society in which even relatively small changes could be effected only by repeated warnings and strict controls (Barron, ed. (1892) 96-7, 149). It has been suggested, however, that there was little or no control over the use of woodland in the Highlands, especially before the eighteenth century. Marshall stated that the barons of northern Perthshire had permitted uncontrolled use of woodland by the large tenantries kept as fighting forces; he also claimed that the woods of the more remote parts of the county had been free for unrestrained use within living memory (Marshall (1794) 24, 27).

Evidence of uncontrolled use is not precise enough to be definite. Thus it was said in 1794 that the inhabitants of Kildalton parish in Islay had the liberty of taking timber for their requirements at pleasure, but this may

indicate only the absence of supervision during cutting (OSAS V.11 (1794) 292). Anarchy in the use of woodland may be concealed by the rarity of written evidence. If it ever prevailed it might be supposed that it would be associated with land use governed by tradition, remoteness from external influences, and the absence of commercial markets for timber; all these factors would reduce the possibility that relevant written evidence might have survived.

With some exceptions like the Glen Orchy court book, the surviving baron court records relate mainly to the margins of the Highlands, but it cannot be assumed that the absence of documentary evidence in itself indicates a total lack of supervision in the interior. In areas where there is no evidence that baron courts consistently exercised control over the use of resources unwritten local usage little less formal in nature governed many activities, and it is possible that the use of woodland was affected by such sanction of custom.

3.3 The form of control

Proprietors were not legally obliged to allow their tenants the use of woodland but reservation from use was profitless unless there was an alternative demand; most proprietors therefore made woodland produce accessible to their tenants under varying degrees of supervision. In some cases sections of woodland were available for the use of tenants and described as 'bogs', although the term has

not been found among evidence relating directly to Argyllshire or Perthshire. Bogs of this type were recorded in Morayshire in the sixteenth century, Kincardineshire in the seventeenth, and near Inverness as late as 1768 (SRO E.721/18, 15-16, Barron, ed. (1892) 85, 114, Cramond, ed. (1903-8) V.1, 90). Between 1660 and 1680 the tenants of the Aberdeenshire barony of Forbes took timber under supervision from bogs. Some at least were enclosed and they were controlled by keepers with duties similar to those of the keepers of the laird's plantations; illicit cutting in both woods and bogs was prosecuted (Thomson, ed. (1919) 244, 265, 276-7).

Where importance was attached to the survival of woodland in a useful form it was realised that supervision was necessary to supplement the protection given by local ordinances and custom. Protective measures such as the enclosure of woodland and the employment of foresters required cash outlay, and deduction from rent was also often necessary if holdings were curtailed by enclosure (below, 4.5); such expenditure could be balanced by substantial returns only if commercial markets were available for the produce. Formal woodland management was rare in the absence of commercial demand, but when profitable markets became available many proprietors took more care to conserve woodland.

The demands of local and external markets could not easily be reconciled. If large timber was to fetch

adequate prices in commercial markets the cutting of good trees for trivial purposes could not be permitted; merchants might also object to the cutting of the best coppice shoots for hoops, as occurred in the regality of Atholl (EUL Dc. I.37 1/3, 11). It was also desirable that wood should be sold in approximately equal sections of consistent quality, and that the relative value of such sections should not be reduced by indiscriminate cutting. It was therefore necessary that tenants should use wood of the lowest quality compatible with their requirements, and that timber for local use should be drawn equally from the whole woodland area or entirely from sections specifically reserved for the purpose; some of the disadvantages of repeated cutting of small quantities could be counteracted by careful supervision.

There were considerable difficulties in managing woodland for commercial profit and at the same time meeting a continued demand from tenants who could not pay prices comparable to those paid by professional timber users. When drafting contracts proprietors in Perthshire and Argyllshire sometimes reserved their tenants' privilege of taking timber for defined purposes, reserved fixed quantities or specified areas for their use, or agreed to compensate the purchaser for timber taken for certain purposes (SRO GD.1/390(54), GD.220 [Wm.26], SC.54/12/9 [a]). In parts of Argyllshire most of the coppice timber was sold for coaling, and there was a permanent shortage of timber for local purposes (Smith (1805) 141). In Perthshire and

Dunbartonshire tenants were often by 1790 required to purchase their requirements, and by the early nineteenth century industrial markets had been found even for the small timber previously given away or sold for nominal prices as fuel (Robertson (1794) 96-7, Whyte & Macfarlan (1811) 155).

The policy of the fifth duke of Argyll in the late eighteenth century indicates the way in which protection of wood could be combined with local and commercial use on a large estate. Illegal woodcutting was severely punished and tacksmen were accountable for woods on their holdings; a small payment was required for house timbers, but the treeless island of Tiree was provided with timber from Sunart without charge (Cregeen, ed. (1964) 7n, 102-5, 108). It was proposed in 1771 that the woods of Morvern should be enclosed; general wood leave was to stop and all timber was to be reserved to the duke but part could be used to supply the locality. The woods were enclosed by 1787 and sold for coaling; certain sections were reserved as haggs cut by the tenants in sequence and the local forester changed residence in order to remain close to the section being used (Cregeen, ed. (1964) 120, 121n, 149).

The abuse of privileges associated with wood and woodland was general in Scottish rural society and particularly in the Highlands before 1800; some of the earliest records relating to wood were complaints about damage, and theft of timber was still a problem in the Highlands after 1800 (Monteath (1827) 61). It was occasionally stated that the

innate dislike of Scottish tenants for trees and especially plantations accounted for much of the damage to woodland. Burt noted that in the Highlands and on their margins tenants thought trees wasteful of space and harmful to the surrounding and underlying ground (Burt (1754) V.2, 51). Rather later Ramsay of Ochtertyre observed that tenants disliked tending plantations on their holdings, as the whole profit eventually went to the proprietor (Allardyce, ed. (1888) V.2, 103).

Such attitudes cannot be disregarded, but in some cases where wilful damage was alleged, theft of timber for domestic use is a more convincing primary explanation. The Earl of Strathmore complained in 1685 that the common people had a natural aversion to plantations, but his annoyance was directed at the cutting of his best trees for humble uses rather than malicious damage in itself (Millar, ed. (1890) 41). In the early eighteenth century young planted trees were cut, enclosures damaged and trespass common on the Aberdeenshire estate of Monymusk. This has been taken as evidence of the active expression of hostility to change, but in the circumstances such behaviour appears to have resulted from carelessness, ignorance, and misunderstanding of new conditions (Hamilton, ed. (1945) lxxii).

It is therefore possible that damage to woodland was caused by obedience to former customs after the introduction of a new regime. The re-education of a population accustomed to cutting timber under limited supervision,

using woodland pasture, and following accepted paths even if blocked by enclosure is likely to have been a slow process. It is also possible that damage was caused by carelessness in following established custom or regulation, or exploitation of the freedom allowed by imprecise rulings and inadequate supervision. Tenants often took timber of high quality for purposes requiring small amounts of inferior wood. The pursuer's case in the dispute over servitudes in Mar stated in 1760 that the users of the servitude cut the heartwood of living pines for candle fir and also cut large trees for trifling reasons; if roof timbers were required the branches were taken and the trunk was left to rot or misused in ways which were not specified, but probably included sale (Michie, ed. (1901) 142).

Theft was a persistent problem. Proprietors at times entered agreement about the punishment of offences committed by their neighbours' tenants, but the trial of miscreants outside the jurisdiction of the baron court could be delayed and uncertain even when the offenders were known (Innes, ed. (1855) 362, Anderson (1967) V.1, 195, 240). In some cases the theft of timber was associated with the turbulence of Highland society; in 1599 a band of thirty broken Highland men raided the Cawdor estate, cutting and removing a large number of young trees (Innes, ed. (1859) 218). In other cases profit was the motive, and timber was stolen for sale in

the burghs of the Highland fringe (Mackay et al. (1911-24) V.1, 155).

Most of the evidence of theft, however, relates to pilfering on a small scale for domestic use by those under the jurisdiction of the proprietor affected. Thus in 1641 twenty-four persons were named as responsible for the theft of wood for local use from the Airlie lands of Glen Isla in Angus, immediately adjacent to the Perthshire boundary; six were small feuars or their tenants from the lower part of the glen but the rest were tenants of the Airlie lands and therefore under the earl's jurisdiction (SRO GD.16/27/124). The problem of control in such cases was different in nature but no smaller. Unless the lands were well policed it was likely that repeated small offences would escape detection; the number of offences recorded in a given period on any one estate is probably related more to the efficiency of detection than the true scale of damage.

Several mechanisms of control were employed. Individual leases and general court regulations commonly emphasised the responsibility of tenants for woods on their holdings and obliged them to act as foresters in these woods; the legal responsibility of the tenant for the actions of his subtenants, servants and dependants was also at times stressed (Innes, ed. (1855) 355, Rogers, ed. (1879-80) V.1, 220, Barron, ed. (1892) 114, Thomson, ed. (1919) 265, 276-7, Adam, ed. (1960) xlix).

The danger was reduced to some extent if a full-time forester was employed. Supervision of areas as large as the wood of Rannoch presented considerable difficulty, however, and foresters were in a position where their small salaries could easily be augmented by dishonesty (below, 6.3). The forester of Kincardine in Perthshire was dismissed for misconduct in 1741, and the oaths and regulations binding the conduct of foresters on other estates suggest that they were not infrequently untrustworthy (SRO GD.220/6/49 (K1743-4), MacGill (1909-11) V.2, 36, Thomson, ed. (1919) 277, 317).

Rewards were also offered for information about illicit cutting. The earl of Strathmore employed bribes to discover cutters of wood in the late seventeenth century; in Rannoch the woodkeeper later gave money and timber to informants and sent reliable men to markets where the stolen timber was sold (SRO E.783/17/1, Millar, ed. (1890) 41). As a last resort penalties might be made as severe as the law allowed. Strathmore believed that his exemplary punishment of some offenders had dissuaded many others; in 1724 first offenders in cutting greenwood were fined, imprisoned, then paraded in the market place of Fortrose in Inverness-shire (Millar, ed. (1890) 41, MacGill (1909-11) V.1, 96). Some proprietors seem to have been reluctant to use the ultimate sanction of eviction for repeated petty offences, and in other cases penalties were ineffective;

thirty cottars charged with the theft of timber from Rannoch in 1753 were so poor that fines were meaningless (SRO E.783/26/11). There seems to have been a tendency to conduct intermittent campaigns against cutting rather than to maintain strict supervision. Courts in Ross-shire more than once charged over a hundred offenders in a single session in the seventeenth century, but the number charged in any one area fluctuated greatly over time (MacGill (1909-11) V.1, 83-4).

Occasional damage was inevitable even on estates managed and supervised according to the soundest principles known to their proprietors; where local methods of management were rudimentary or casually enforced the cumulative effects of sustained abuse must have been severe. Most effort appears to have been devoted to suppression of the more obvious abuses, and the unsatisfactory nature of accepted techniques was seldom recognised and less frequently remedied. Some inefficiencies, such as the use of the only available species for purposes to which it was ill-adapted, were unavoidable in the circumstances; others could be remedied only by radical economic and social change (below, 3.8). It is evident that familiar practices were often retained until it became abundantly clear that they were unsatisfactory; even if fully enforced the methods of management and control employed can in many cases have done little to arrest the deterioration of woodland.

3.4 The use of large timber

As already noted woodland was intermittently distributed through Perthshire and Argyllshire, and the supply of large timber for any kind of construction was a major problem (above, 2.4); the physical difficulties of the carriage of material over land limited the use of large timber, whether foreign or imported from other parts of the Highlands with better supplies. Water transport made distance a smaller obstacle to movement in coastal Argyllshire, but the carriage of timber was in the best of circumstances expensive. The movement of timber could be a matter of concern even within the boundaries of a Highland estate; when a few houses were built at Campsie in Angus in 1626 local woods could supply only part of the requirements and the bulk of the timber had to come from other parts of the Airlie estate more than twelve miles (19 km) distant (SRO GD.16/27/41).

Sawmills cutting timber for local markets were rare and relatively late to appear; mechanically-cut plank and board was therefore not in common use. Methods of timber working were unavoidably wasteful both of material and time; the adze and other hand tools provided a slow and laborious means of stripping, trimming and shaping timber (Grant (1961) 245). It is evident that timber was frequently put to use with little preparation except the lopping of projecting branches; precision in building was lost and structures tended to be massive and

clumsy (Dunbar (1956-7) 91). The by-products of saw-mill operation, including backs and other useful off-cuts from the squaring process, were not available.

There was a clear distinction between the construction of urban and rural buildings in Scotland before the middle of the eighteenth century. Imported deals were widely used in the larger towns, most of which were coastal or estuarine (Lythe (1960) 144-5). The burghs of the Highland fringe were not exceptional; the buildings of Inverness in the 1720s required large quantities of timber, and when Loveday visited Perth in 1732 he found a large proportion of wooden tenements which he considered to be out of keeping with the prosperity of the town (Burt (1754) V.1, 57-60, Loveday, ed. (1890) 130). Change in the nature of the cities and increased concern about the danger of fire eventually had an effect on building style and materials, and by 1769 the old wooden tenements had almost disappeared from Perth (Pennant (1771) 69-70, Smout (1960) 3-4). Timber had a much smaller role in building in the rural lowlands and the Highlands before 1750. In lowland Angus imported timber was used by rural proprietors and the townspeople in the late seventeenth century, but local wood sufficed for the houses of the common people (MacNair, ed. (1883) 21). Housing was uniformly poor in quality in the Highlands at that time, and continued to be so after 1800.

Burt claimed that it was possible to travel for a hundred miles (161 km) in the Highlands without seeing any dwelling except huts of turf (Burt (1754) V.2, 186). Exaggerated as this account may be, it agrees in substance with Campbell's laudatory description of the simplicity and material poverty of the homes of gentlemen farmers or tacksmen (Campbell (1752) 20-1). When he visited Mull and the adjacent islands in 1688 Sacheverell found only one house with panelling, and in 1760 Pococke noted that with few exceptions the best houses on Mull were mere thatched cabins built of large stones (Sacheverell (1702) 144, Kemp, ed. (1887) 89). Most accounts emphasised that only a small social stratum occupied houses of any quality by external standards; the vast majority of the population lived in small and primitive buildings.

The lack of suitable large timber and equipment for timber working was reflected in a housing style which used limited amounts of wood and methods of construction which did not require well-finished timber. Almost all Highland buildings were confined to a single storey, and any necessary enlargements were horizontal rather than vertical; in some cases there was a small loft for use as a barn or sleeping accommodation (SRO E.783/60/18, Dunbar (1956-7) 81, Gaskell (1968) 74). The basis of construction was a timber frame, the most important elements being a series of 'couples' or pairs of timbers

lashed or pinned together at the apex of the roof. The pairs were connected and the structure strengthened by horizontal purlines or 'pantrees' aligned parallel to the long axis of the building. This skeleton was covered by a fibrous thatch, which in most cases was supported by a layer of wattle or rough rafters called 'cabbers' lying over the pantrees.

There were distinct regional construction styles. In most of Perthshire and other eastern and central districts structures were massive and required relatively large amounts of timber; the framework consisted of sets of crucks set in the ground or founded on drystone, with intercalary drystone built up around them (Dunbar (1956-7) 81-91). In Argyllshire and southwest Perthshire the couples rested on drystone walls and full stone gables supported the ends of the pantrees (Grant (1961) 142-51). Conservatism in the application of building techniques appears to have been a major force in the preservation of these styles; cruck-framing was retained in northern Perthshire in association with massive drystone walls sufficient in themselves to support a couple roof (Dunbar (1960) 116). These regional forms had in common a general crudity of construction; the following account of housing in southwest Perthshire describes the western form.

"Upon stones and pebbles mingled together, and reared outwardly without cement or plaister into four

rough walls about five feet and a half high, some rude unhewn poles, often about the same height, are placed parallel to each other and reach, angularly, one transverse beam or rafter at the ridge. A few light pieces, upright or horizontal, are nailed at the sides. A quantity of oat straw, not very artificially laid upon split sticks nailed over these poles, constitutes the roof". (Lettice (1794) 280-1).

This description emphasises the importance of the couples and the main roof beam or rooftree. The importance of the component parts of the frame varied. Burt visited an inn near Inverness where the rooftree was absurdly large in relation to the crooked couples (Burt (1754) V.2, 36); in Perthshire and Angus more importance was attached to the couples and the rooftree may have been relatively light (SRO E.783/60/111(2), E.783/60/174(2), GD.16/27/41). Fairhurst found that in a Sutherland settlement the couples of individual buildings had varied greatly in size and form (Fairhurst (1967-8) 145-6); tenants evidently accepted such timber as was available, and a similar irregularity in building style may have been common in the less well-wooded parts of the southern bounties. Collectively, however, the timbers were of some value, as is indicated by the practice of moving the few essential timbers from one house to another.

In Argyllshire and other areas where roofs rested on drystone walls, the weight of the frame made renovation

of the stonework a frequent task (Smith (1805) 18); in many cases a new house was built as a replacement, using the timbers of the old house. In coastal Argyllshire Burt observed a large number of ruined cottages without roof timbers converted to use as kailyards; he was told that this was done by tenants moving house without leaving their holdings (Burt (1754) V.1, 27). Tenancy in the Highlands was often short and tenants moved frequently to new holdings; the stonework was left to decay or to be renovated by the incoming tenant but the roof timbers were removed. Such a practice was recorded in Kincardineshire at the beginning of the eighteenth century and in Aberdeenshire about 1760 (Barron, ed. (1892) 113, 116, Michie, ed. (1901) 142).

Assessments of the requirements for housing timber even in a single community over a given period is far from easy. The amount of suitable timber available depended not only on accessibility but on the liberality of the proprietor and the care with which he policed his woods. Where timber was scarce roof members might be made to serve until the final stages of decay; in such circumstances tenants might also be compelled to accept timber insufficient in quality and quantity by the standards of districts where wood was abundant. Regional differences in building style also affected the number of strong verticals and horizontals required. In Perthshire a set of couples was generally necessary near each end wall,

with two to four sets between (Symon (1959) 27); in Argyllshire stone gables were employed and couples were spaced between them at intervals of six feet (1.8 m) (Smith (1805) 17).

Other factors must be taken into account. A tenant on Struan estate in Perthshire petitioning for timber for a house forty-two feet (13 m) long in 1765 asked for no structural timber except three couples and two joists (SRO E.783/60/111(2)); it is possible that he already possessed suitable timbers taken from a previous house. Terminology was not uniform; houses built at Campsie in Angus in 1626 each required two couples and twelve pans or pantrees, and house timber reserved from sale on Loch Awe in 1714 also included six pantrees per couple (SRO GD.16/27/41, SC.54/12/7 [b]). Between early 1788 and the middle of 1789, however, the island of Tiree required 312 couples and only 316 pantrees; it is probable that terminological variation explains this difference (Cregeen, ed. (1964) 17-18).

The tenants, stock, equipment and stores of a farm traditionally shared a single large room divided in some cases by light partitions; there seems to have been some regional differentiation, however, with more general use of separate outbuildings in the east and centre (Grant (1961) 75). Houses were also built at shieling sites. Tenants in Glen Isla stole timber to build shieling houses in 1641, and in the Cairngorms shieling houses

ranged in quality from primitive dug-outs to conventional pan-and-couple structures (SRO GD.16/27/124, Gaffney (1960) 25). The ruins of shielings in north Skye indicate the use of timber in roofing; Pennant saw and sketched conical shieling huts on the shore of Jura, built of branches covered with turf (Pennant (1774) 216, MacSween (1959) 78). A limited number of other buildings were required by the Highland economy; churches and mills were the most important, but both were clearly far fewer than farm buildings.

All the factors outlined above must be taken into account in any assessment of the building timber requirements of Highland communities; some factors are unquantifiable, some variable from district to district, and others represent conflicting trends which probably varied in balance within any one area over relatively short periods. There is some evidence of the quantity of timber required for a single house. Those built at Campsie in 1626, in the more massive tradition of Perthshire and the east Highlands, each needed twenty trees for the basic structure and an undefined number of cabbers; in this instance the term 'tree' probably refers to a stem of a certain length, possibly between ten and twelve feet (3.0-3.6m) long (SRO GD.16/27/41).

In other cases there is some indication of the quantity used over a period. Tiree was almost treeless and was supplied with recorded quantities from a single

source. In 1788 and 1789 312 couples, 316 pantrees, and 6,640 cabbers were supplied to a population of about 2,000 persons (Gray (1957) 71, Cregeen, ed. (1964) 17-18). In this case the total requirement was increased by the necessity of replacing houses engulfed by moving dunes, but the number taken by a small population within a short period is still remarkably high. Highland building methods required a limited amount of wood and essential timbers were carefully conserved, but wastage and population increase must both have contributed to a consistent or increasing demand, which was without doubt the major consumer of large timber in the Highland economy.

The type of timber employed varied from region to region. Pine timber was very suitable and imported pine was generally used in urban construction, but pinewoods were absent from much of Argyllshire and uncommon in Perthshire (~~below~~ above, 2.4). Most demands in Argyllshire and northern Perthshire were probably met by birch and alder, but there is some evidence of the use of other species. Specific hardwoods were required in the construction of mill machinery; planted plane or sycamore was obtained in some cases but oak was also used as mill timber (SRO GD.1/390(54), GD.220/6(50) (M1759), SC.54/12/10 [a]). When oakwoods on Loch Awe with some ash were sold in 1714 the proprietor reserved peeled oak for couples, pantrees and cabbers (SRO SC.54/12/7 [b]).

Oak and ash were less common than birch and comm-

ercially more valuable; they were at times excluded from the timber available for local use. A tack of the lands of Sunart in 1744 reserved the timber of commercial value for the proprietor but allowed the tacksman to use birch, alder and hazel freely for houses and buildings on the lands (Megaw (1963) 203.) As coppice management expanded the mature trees known as standards became available for use; in Strachur parish on Loch Fyne the oak standards proved to be of little commercial value, and they were employed mainly for couples and rafters (OSAS V.6 (1793) 90). The timber of oak coppice itself was suitable. Newte observed that Highland coppice cut between twenty and twenty-five years of age yielded timber fit for implements and roof timbering (Newte (1791) 241). Scottish coppice yielded little large timber at such an age, however, although most would be adequate for use as the lighter roof timbers (Monteath (1824) 261-4).

Commercial fishery had a very limited place in the old Highland economy, and boats were built largely for inshore fishing and communication (Hamilton (1963) 111). Such boats were employed in Argyllshire and they were also used on inland rivers and lochs in Perthshire; as late as 1793 several ferries like the boat of Logierait operated on the Tay (Heron (1793) V.1, 223). A relatively large quantity of timber was required for each; in 1759 a ferryman on Loch Rannoch claimed that a ton of timber (equivalent to the produce of three mature pines) was

required for a boat designed to carry a horse (SRO E.783/60/25). Boat-building commonly employed crooked and straight oak and birch (NLS MS.995, 19, Blaikie (1829) 365-6, Thomson, ed. (1864) 48). Large timber was also required in bridge-building, but before the end of the eighteenth century the majority of Highland rivers appear to have been crossed by ferry, ford or by primitive bridges of the type seen by Burt, consisting of unsquared pine trunks laid across a narrow stretch of the river (Burt (1754) V.2, 74). As late as 1824 bridges of rough trees were common in the southern parts of Highland Perthshire (MacCulloch (1824) V.1, 130).

3.5 The use of small timber and brushwood

Sections of timber less than six inches (15.2 cm) in diameter were conventionally regarded in the Scottish timber trade as 'unmeasurable' or 'small' timber, and excluded from valuation when standing timber was sold. Such timber was widely used in the Highlands, and when bark coppice was sold the small timber was usually granted to the purchaser for local disposal unless it could be sold for coaling or comparable uses (below, 8.4). A certain amount of small timber was incorporated in the building structure, replacing or supplementing some of the larger horizontal and vertical timbers (Lettice (1794) 280). The cabbers which supported the thatch were pieces of small timber; in north Perthshire rough

branches stripped of twigs and leaves were employed (Marshall (1794) 20). It is likely that small timber also found roles in mill-furnishing, boat-building and other forms of construction.

The use of wood for domestic flooring, panelling and ceiling work was rare in tenant houses and limited in those of lairds and tacksmen. A primitive form of wood-framed chimney was occasionally used, but the elaborate chimney funnel of the smith's house at Dalmally in Argyllshire, which enclosed most of the main room, must have been exceptional (Lettice (1794) 281, Geikie, ed. (1907) V.1, 291-3). Timber was at times used for door frames and window framing. The door frames of the houses built at Campsie were massive and may have been extended to form roof supports; window timber was provided by the loppings of wood cut for other parts of the house (SRO GD.16/27/41). Door and window frames were at times devoid of timber, however, and although small sections of plank were used as shutters for the unglazed windows wickerwork rather than board was frequently employed as a door (Lettice (1794) 281, Anon. (1819) 41).

Furniture was generally rudimentary and limited in quantity throughout the Highlands. Late accounts, which probably provide a more favourable account than would be appropriate to the seventeenth or early eighteen centuries, indicate that in general the furniture of a Highland tenant house in the late eighteen century consisted of

one or more benches, stools, perhaps one table and chair, simple shelves or a cupboard, chests and bed-frames (Boswell (1785) 145, Lettice (1794) 283, Anon. (1819) 41, Geikie, ed. (1907) V.1, 293). The inventory of a house in Rannoch completely destroyed by fire in 1770 included four beds, six chests, three partitions, a door, a cupboard, seats, tubs and milk containers (SRO E.783/60/174(3)).

Tools and farm implements were generally wooden, even where iron or other metals would be more suitable. Burt recorded the use of wooden spades, ploughshares and harrows (Burt (1754) V.2, 122-3). The conventional plough was made almost entirely of wood with a ring of iron binding the coulter and sock; the light ploughspade or cas-chrom and more conventional spades also included only small pieces of iron (Gray (1957) 46, Fenton (1962-3) 302-16). In certain cases metal was indispensable; the axe and the sickle, which were universally employed in harvesting, both required metal blades (Hamilton (1963) 45). Implements were made by the intending user or at times by local craftsmen; the majority of tenants in southwest Perthshire made their own implements even in the late eighteenth century (Allardyce, ed. (1888) V.2, 198). Traditional methods were persistent and the old plough and wooden-toothed harrow were still in regular use in Argyllshire about 1800 (Smith (1805) 64-5).

Domestic utensils were also generally wooden; pottery had little place in the Highland economy and the use of metal was confined largely to pots and kettles (Boswell (1785) 144, Lettice (1794) 283, Grant (1961) 178). In the middle of the eighteenth century butter was sold from large wooden dishes in Inverness market, and milk was dispensed from goatskins into small saucers; wooden plates and spoons were also sold (Anon. (1747) 167, Ray (1752) 350, Burt (1754) V.1, 79). Utensils were made of wood or pewter in Nether Lorn about 1770, and included bowls and dishes, tubs, pails and stoups (Grant (1919) 147); in coastal Argyllshire and the islands visitors were commonly offered milk from large wooden dishes (Garnett (1800) V.1, 221-2, Kemp, ed. (1887) 88).

Transport was a problem in the Highlands throughout the period; effective bridges were uncommon, and the military roads of the early eighteenth century served a limited area without a network of surfaced feeder roads. Wheeled transport therefore had little place in the old Highland economy; the four-wheeled cart or wagon remained rare in Scotland and especially in the Highlands for some time after 1723, when carts were sufficiently novel in parts of Lanarkshire to attract crowds (Graham (1899) 167). A primitive form of two-wheeled cart, the tumbler or kellach, preceded the four-wheeled cart in parts of the Highlands and on the Highland margins; even in lowland Perthshire tenants continued to use tumblers

relatively late in the eighteenth century (Allardyce, ed. (1888) V.2, 217-21).

The wheel-barrows used to carry peats in rural areas in the early eighteenth century were probably similar in size and construction; such barrows were in use for the carriage of peats at Ballachulish in 1770 (Mackenzie (1710-12) 297, Craven, ed. (1886) 311). In some parts of the two counties the only available forms of carriage were a type of sledge and baskets or creels carried by men or horses. The Highland sledge consisted of a frame of two sapling trunks and a light superstructure (Grant (1961) 281); sledges were still to be seen carrying dung and performing statute duties in upland Perthshire in the later part of the eighteenth century (Allardyce, ed. (1888) V.2, 199, 220-1). In remote parts of Argyllshire sledges were used to carry peat and dung and horse-drawn frames to carry hay and corn (Smith (1805) 65).

Permanent wooden fences were not common in the old Highland economy; stone was generally used for permanent division, although ruinous drystone walls might be repaired with rough timber (SRO E.783/98, 8). Temporary wooden fences were employed in some districts at certain seasons. The enclosure of crops and grass in the growing season to exclude grazing animals was practised in the Cairngorms, and in parts of the south Highlands where small and scattered arable plots lay among the pasture (SRO GD.220 [Wb.4], Pears (1968b) 49). Cruives or fish traps on

tidal flats were commonly made of wattling on frames of sticks (Bell (1838) 239).

Accounts of the species which provided small timber for these uses as a whole indicate that birch and alder had an important role in most Highland areas. Birch had a wide variety of uses, and according to Blaikie both birch and alder were commonly used for implements and other items requiring small timber (Robertson (1808) 212, Singers (1829) 142-3, Blaikie (1829) 362-6). Ash was traditionally the 'husbandman's tree', and by its nature was well suited to the production of a variety of utensils including hoops, tool handles, harrow timbers and oars; oak had considerable value as timber (Monteath (1824) 196-8, Thomson, ed. (1864) 6). Neither was uncommon in Perthshire or Argyllshire but they were rarely described as being used for such purposes; this may be ascribed in part to their reservation from use by proprietors interested in commercial coppicing, and the profitable markets available for small coppice timber in some districts (below, 8.4).

Birch and alder had intrinsic advantages for certain uses. Birch was preferred to elm and ash for harrow bills, being tougher and more resilient (Monteath (1824) 196-8). Birch timber was hard and suitable for carving; it was also less likely than some timbers to taint the contents of vessels, and consequently was preferred in the production of containers for milk and butter (Blaikie

(1829) 364-5, Grant (1961) 148). Alder timber was soft but durable in wet conditions, homogeneous, and resistant to splintering; it was commonly used for wooden vessels, posts and stakes set in water or wet ground, cart boxes and sledges (Blaikie (1829) 362-5, Thomson, ed. (1864) 235).

Although in some cases these advantages may have been marginal or counterbalanced by the favourable characteristics of other timbers, birch and alder were not only common but useful in themselves. These timbers had sufficient versatility to make it likely that they were extensively used before commercial considerations restricted the availability of oak, ash and pine. Other species were also occasionally used. Large hazel shoots were used in cooperage in Perthshire (EUL Dc.1.37 1/3, 11). Pine was employed when available for domestic furnishing; tenants in Rannoch petitioned for local deals to build lofts, partitions, windows and doors (SRO.E.783/60/18, E.783/60/26, E.783/60/34).

Specialised craftsmen played a limited role in producing items which required small timber, generally on a part-time basis. The author of the proposals for the regality of Atholl in 1708 observed that 'country coopers' were active in the district; these men made and repaired vessels in their customers' homes, using timber provided by the intending user. Travelling shoemakers plied a similar trade in the area north of Dunkeld on the Highland margin, using leather tanned by their customers, but

carpentry and timber work about the farm was generally done by the tenants themselves (EUL Dc.I.37 1/3, 11, 13, 18). The expansion of craft work was slow; as late as 1782 remarkably little of the produce of the pinewood of Rannoch, which served a similar and adjacent part of north Perthshire, was sold to professional timber workers (below, 6.5).

Large areas in both counties were covered by stunted and irregular scrub and brushwood; material with similar characteristics formed the residue after the felling and trimming of timber, and the flexible shoots of young coppice growth were also utilised (below, 7.4). Flexible brushwood was woven in a variety of ways throughout the Highlands. Partitions of wickerwork and wattle were used to divide buildings internally, consisting of upright stakes interwoven with twigs and plastered with clay (Boswell (1785) 144-5, Heron (1793) V.1, 223, Anon. (1819) 41); the same material was used to provide doors, wall linings, and shelves (Burt (1754) V.2, 36, Pennant (1774) 216, Lettice (1794) 281). Wicker baskets and creels were common, especially where there was no other convenient means of carrying goods (Garnett (1800) V.2, 53, Gray (1957) 46-7).

Imported rope was in use in some parts of Highland Perthshire by the early eighteenth century but was not generally accepted; a number of materials were still substituted for rope after 1800 (EUL. Dc.I.37 1/3, 10).

Ropes of twisted birch twigs were seen in use as horse harness, in fishery, and as climbing ropes or ladders (Burt (1754) V.1, 72, Garnett (1800) V.1, 319-20, Thornton (1804) 65n, Oswald (1811) 21, Herford, ed. (1929) 161-2). Brushwood was also used to provide roofing and to sew thatch; it was used for temporary and occasionally permanent fences and cruives (Heron (1793) V.1, 332, Walker (1812) V.2, 257, Singers (1829) 139-43). In Argyllshire ferries carrying livestock were at times lined with birch and other brushwood to protect both boat and animals (Johnson (1775) 258, Kemp, ed. (1887) 68, Cregeen (1959) 148).

Birch, alder and willow were similar enough in character to be interchangeable for many purposes, and hazel was widely employed both in weaving and in cooperage (Walker (1812) V.2, 257-8, NSAS (1845) V.7 (Argyll), 237, Gilchrist (1876) 213-4). As shall be seen later, there is evidence of casual coppicing of alder in the Highlands (below, 7.4). The species employed is not often determinable; material for such uses was generally described simply as withies or wands. Thus the baron courts of Forbes and Urie prohibited the cutting of wands in the late seventeenth century and in 1708 the inhabitants of the regality of Atholl were cutting withies for hoops, ropes and other uses (EUL.Dc.I.37 1/3, 10-11, Barron, ed. (1892) 114, Thomson, ed. (1919) 277). As late as 1760 men from the Highlands brought withies for sale to fairs at Doune and other towns in southern Perthshire (Allar-

dyce, ed. (1888) V.2, 198).

Brushwood was also used as fuel; in some cases dead wood was made available. In the regality of Atholl cottars, the poor and children were allowed to collect dead wood as fuel; it was said that the users of the privilege damaged living trees on each visit to ensure a supply of dead wood for later collection (EUL Dc.I.371/3, 11). At Inveraray about 1800 the poor were permitted to collect rotten branches and the droppings of trees (Garnett (1800) V.1, 83). In other parts of the two counties usage may have followed that of other parts of the Highland fringe where the use of dry wood was prohibited relatively early, perhaps as a result of abuse of privileges; in the barony of Leys in Kincardineshire it was pronounced in 1623 that those burning dry wood were to be subject to the same penalties as those cutting greenwood, and in Forbes barony it was an offence in 1663 to take fallen or decayed timber, known locally as 'rot tres' (Stuart, ed. (1852) 222, Thomson, ed. (1919) 243-4).

Almost all accounts of the fuels used in the Highlands emphasise the importance of peat, and to a lesser extent turf and broom. Timber was probably burned regularly in certain circumstances; the loppings of trees cut for other purposes might be used as fuel, as might timber of no further use for its original purpose. Advocating the planting of coppice in lowland Scotland, Sibbald stated in 1698 that it would be important as a

fuel supply (NLS MS.33.5.16); the regular burning of wood appears to have become common, however, only when other fuels became scarce or unobtainable.

Temporary shortages of peats were not unknown, especially when severe winters followed wet summers. In such circumstances tenants were compelled to burn furniture and even house timbers; in some districts of Argyllshire fuel was made available from woodland during such emergencies (OSAS V.11 (1794) 292, V.17 (1796) 286). More serious was the gradual deterioration and exhaustion of reserves of peat and turf. Scarcity was evident in some districts after 1750, and the parish reports of the Old Statistical Account relating to Perthshire and Argyll indicate relatively widespread decline (OSAS (1791-99). The levy on the coastal carriage of coal was removed in 1793 but coal was in any case expensive except in the immediate vicinity of the pit (Duckham (1970) 34-7). Even in lowland Perthshire coal was little used in some parishes close to the coalfields, and the shortage of fuel was a matter of great concern in parishes farther removed from supplies of coal (OSAS V.7 (1793) 329, V.8 (1793) 357-8, V.17 (1796) 196).

As the supply of peats declined the development of estate forestry provided an increasing supply of peeled coppice wood, plantation thinnings, loppings and prunings suitable for burning. If references to bog timber are excluded the use of wood as fuel was recorded in eleven

of the seventy-one parishes of Perthshire in the Old Statistical Account and in twenty-seven in the later account. Part of this increase can be explained by the higher quality of the second account, but it was acknowledged in Perthshire that wood was increasing in importance as a fuel; thus in Comrie parish the extension of oak coppice was said to have alleviated fuel difficulties (NSAS (1845) V.10 (Perth), 595). The use of wood as fuel was not recorded in Argyll in the 1790s and in only one of the thirty-eight parishes in 1845. The exhaustion of peat and the high cost of coal was frequently noted in the Old Statistical Account and a greater use of wood might have been expected; some explanation is provided by the continued and large demand for timber to produce industrial charcoal through the period, and the relative rarity of plantation (Smith (1805) 140, below, 11.4).

Most of the parishes of Perthshire in which wood was reported to be in use were in the southern part of the county; peeled coppice oak, plantation products, and the by-products of sawmilling predominated. In Killin parish a certain amount of semi-natural timber was used in 1796, however, and fallen branches, decayed timber and the small wood of planted trees cut for local use were burned in other parishes (OSAS V.3 (1792) 305, V.17 (1796) 383, NSAS (1845) V.10 (Perth), 344, 450, 1141). Fuel wood was rarely given away except to the poor, and was

most commonly sold at set prices at annual sales, or whenever areas of coppice or plantation were cut or thinned (OSAS V.9 (1793) 601, NSAS (1845) V.10 (Perth), 595, 684, 1141). Peeled oak was considerably more expensive than peat and in some parishes was used only by the more substantial tenants (NSAS (1845) V.10 (Perth), 109, 526, 701, 782).

It may also be noted that uses were found for leaves; several types were the source of dyes used in the Highlands (Ross (1885-6) 400-1). A practice more harmful to woodland was that of cutting branches of holly and other edible growth as fodder in severe winters; there is evidence that this was occasionally done but the practice does not seem to have been employed in Perthshire or Argyllshire, and in 1812 Walker observed that it was rare in the Highlands as a whole in comparison to the rest of northwest Europe (Walker (1812) V.1, 388-9, Anderson (1967) V.1, 510). The regular cutting of holly as winter fodder in Britain seems to have been confined to the southern Pennines, where it was recorded between the fifteenth and nineteenth centuries (Radley (1961) 90-1).

3.6 The use of bark

The use of oak bark in commercial tanning was of great importance in both counties, especially in the eighteenth century (below, 8.3); the barks of several species were also used in the domestic sphere. A major use of

tanning bark was in the tanning of brogues, a practice which travellers observed as continuing after the end of the eighteenth century. Johnson and Boswell stated that the inhabitants of Coll all tanned leather for their brogues; Garnett noted that domestic tanning was common on Mull and Walker recorded tanning on Colonsay, Coll and Tiree (Johnson (1775) 212, Boswell (1785) 373, Garnett (1800) V.1, 155, Walker (1812) V.2, 258). Domestic tanning was not confined to the western isles; according to Marshall it was universal in north Perthshire at the end of the eighteenth century (Marshall (1794) 24).

The other main use of bark in tanning, necessarily limited to coastal districts, was the protection of fishing gear. Accounts of this technique are unfortunately late, but there is no reason to believe that it was not established to some extent before 1800. When he visited Loch Fyne Garnett noted that nets were soaked or boiled in a solution of oak bark to prevent rot (Garnett (1800) V.1, 95). In 1829 birch bark was still used for this purpose and in 1864 oak bark was used in the preservation of nets, sails, and cordage (Blaikie (1829) 366, Thomson, ed. (1864) 162-3). According to Darling shepherds on one west Highland estate about 1865 were paid partly in birch bark which they stripped for themselves and sold locally for the tanning of sail canvas (Darling (1955) 170).

There is a general emphasis on birch which suggests

that it met local requirements adequately. According to Boswell the tenants of Coll used both oak and birch, but the latter appears to have been preferred in the tanning of fishing gear (Boswell (1785) 373, Blaikie, (1829) 366). In the sixteenth century Grant of Grant petitioned parliament about the illicit cutting of standing birch (Pears (1968b) 49-50); a number of later accounts also emphasise the use of birch bark in the tanning of brogues and fishing tackle (Robertson (1808) 213, Cameron, ed. (1949) 14-16, Darling (1955) 170). Alder and willow barks were inferior but both were employed; tanning with willow bark was common in the western islands at the end of the eighteenth century (Garnett (1800) V.1, 155, Walker (1812) V.2, 258, 291-2). Non-tree species were also employed; according to MacCulloch tormentil roots were used to tan brogue leather throughout the Highland area (MacCulloch (1824) V.1, 190).

Domestic dyeing also used a variety of barks; several were recorded in use in Nether Lorn in 1770 (Grant (1919) 148). Ross later listed no fewer than thirty-eight trees, bushes, herbs and lichens from which Highlanders extracted dyestuffs (Ross (1885-6) 400-1). Alder yielded a black dye, and oak and birch barks dark brown and yellow respectively (Singers (1829) 142, Thomson, ed. (1864) 48, 162-3). The suggestion by Pears that birch bark was peeled as fodder is not substantiated by contemporary evidence (Pears (1968b) 49-50).

3.7 The use of bog timber and driftwood

The timber found preserved in the peat bogs of the Highlands was used for a variety of purposes; although these differed in some cases from the uses of fresh timber the availability of bog timber must have eased pressure on timber resources to some extent. Bog timber had little place in construction; Mackenzie stated that it was fit for working but dried to a usable state very slowly, especially the oak (Mackenzie (1710-12) 298). It was a convenient resource for the building of shieling houses; these were often on sites where access to growing trees was difficult, and the standard of construction required was lower than in the case of the winter house. Bog timber was traditionally used thus in the Cairngorms (Pears (1968b) 50); this was probably also the case in north Skye in the eighteenth century, and in the following century iron rods were taken to the hill in summer in Gairloch to probe for bog timber (MacSween (1959) 78).

There is no direct evidence of such use either in Argyllshire or Perthshire, and in these counties the principal value of bog timber appears to have been as a source of heat and light. Tenants in Fortingall parish in Perthshire searched widely for bog pine for lighting and fuel in the 1790s, and the practice had ceased only a short time previously in Killin parish (OSAS V.2 (1791) 451, V.17 (1796) 372); it was still used thus in Glen Orchy parish in Argyllshire in 1845 (NSAS (1845) V.7

(Argyll), 92). Bog timber was at times burned with peat; in 1804 Dorothy Wordsworth observed that the wet peats used at King's House on Rannoch Moor burned only with the assistance of the decayed timber dug with them (Shairp, ed. (1874) 177).

For use in lighting the resinous wood of bog pine, which burned brightly, was split into strips or splints; these were used in place of candles and commonly called candle fir (Burt (1754) V.2, 115-16, Geikie, ed. (1907) V.1, 293-4). Pine heartwood from living trees was also cut for this purpose, a custom deplored by foresters; the woodkeeper of Rannoch found in 1751 that many large trees had been damaged in this way (SRO E.783/17/1). Roots of bog pine were also made into a kind of rope, which was still produced in some parts of the Highlands in the late nineteenth century (Jameson (1813) V.2, 127, MacNair, ed. (1883) 22-3, Ross (1885-6) 407-8).

The value of bog wood was realised relatively early by the inhabitants of the Highlands, and a regular trade developed with the towns of the fringe. Bog pine from Badenoch was sold at the weekly markets of towns in Angus and east Perthshire until the later part of the eighteenth century and bog wood from the Cairngorms was sold on the northeast coast (Anon. (1819) 35, Pears (1968b) 50). Lighting splints were probably the main items sold, and much of the candle fir of Rannoch appears to have been sold in this way (Hunter (1883) 413-4). In the eight-

eenth century the duke of Gordon and other proprietors claimed the bog pine of extensive areas for themselves (Pears (1968b) 50). It is not likely that they anticipated any commercial profit; it is more probable that these measures were designed to confine the use of bog timber to the inhabitants of the estate, perhaps as a means of reducing pressure on resources.

Bog timber was often discoloured, distorted and fragmented; it may therefore have been of limited value for uses requiring precision, but it was probably used widely for casual use on the farm in the form of props, struts and timber for rough repairs. Pine and oak were the species most commonly identified, and pine was in most cases the more common. In a limited number of cases specific uses were found for bog oak; scythe sharpeners were made from it in Fortingall parish (NSAS (1845) V.10 (Perth), 532). Pine had intrinsic advantages for production of lighting splints and rope, and was more often named in accounts of the use of bog timber as fuel.

Another form of timber occasionally available, especially on the west coast, was driftwood. Timber washed ashore was at times large in dimensions and of valuable exotic species; some came from shipwrecks and was already shaped, but other pieces appear to have drifted by natural agency over considerable distances. Spruce and pine incorporated in prehistoric dwellings may have originated on the east coast of North America (Graham (1952) 133).

Such wood may have been a valuable resource, especially on the more barren and isolated islands; when timber of this type was washed ashore in Mull and Morvern in the late eighteenth century it was quickly claimed on behalf of the duke of Argyll and put to use for the benefit of the estate or the community as a whole (Cregeen, ed. (1964) 147, 183).

3.8 The effects of the non-commercial use of woodland produce

It has already been observed that the effects of sustained pressure from agricultural communities are among those least amenable to precise evaluation, and that a primary aim of this study is to obtain a measure of their importance indirectly by assessing the significance of other factors less complex in their natures (above, 1.5). The main effect of the non-commercial demand for woodland produce is a sustained and complex form of pressure consisting of a huge number of small individual episodes; assessment is clearly difficult even when evidence is abundant, and in this case the problem is magnified by the paucity of available evidence. The preceding pages can be regarded as no more than an initial survey in a field which requires independent study based on field archaeological techniques and exhaustive examination of documentary material of possible relevance.

It is possible to assume in the absence of definite evidence that Perthshire and Argyllshire were affected

by certain aspects of Highland material culture which are known to have been widespread and others which were less common but were present in adjacent districts; certainty is impossible in either case and the evidence available at present is insufficient to provide a basis for any more than tentative suggestions about the role of non-commercial demands on the quality and extent of woodland in the two counties. It must also be remembered that the actual pattern of demand for woodland produce in these counties is likely to have varied both regularly and irregularly in spatial terms and over periods of time. The preceding survey does however give some indication of the overall range of uses for woodland produce and those, like the demand for house timbers, which are likely to have been important throughout the area in the whole period.

It has already been noted that throughout the period populations in both counties tended to be dense in relation to resources, although neither county suffered the extremes of overcrowding found in other parts of the Highlands in the later part of the period (above, 2.5). The effects of population pressure may have been mitigated by the relatively small timber demands of individual tenant households. Timber was vital in the construction of buildings but much less was used in any one case than in the construction methods employed outside the Highlands, and very little was required for internal finishing and furnishing. Thorough use was made of small timber,

brushwood, and other materials of low quality which could often be obtained when local reserves of large timber were temporarily depleted or completely exhausted.

Although woodland produce was thoroughly used it was not always used efficiently. The timber available in any one area was not always the most suitable in form and species for a given role, and the general absence of professional full-time timber-workers also had serious consequences. In many districts each tenant had to find, cut, and work his own timber; the advantages of specialisation and the economies of scale were lost and time was thus spent which might more profitably have been allocated to improvement of the farm. Most tenants had some competence in woodworking and the form of implements not infrequently showed considerable ingenuity in utilising the natural shape of timber (Grant (1961) 104n); despite this the efficiency of operations was less than that which could be expected from professional timber workers.

Thus it was said of the regality of Atholl in 1708 that the use of drystone encouraged the spread of damp and the rotting of house timbers; in replacing these and other timbers on the farm tenants used three times the amount of wood required if the work was done by skilled carpenters. It was estimated that the average husbandman allocated two thirds of his time to timber craft and work in the woods; even the local coopers were less

efficient than was desirable, working on a basis of individual orders rather than carefully-controlled production (EUL. Dc.1.37 1/3, 10-13). It is not improbable that the author of this account overstated his case, but the account nevertheless indicates a remarkable inefficiency and waste of time and timber, which could be counteracted only if timber work was carried out by professionally skilled men with the appropriate tools and materials.

Genuine transformation of the wood economy in such a way that the pressures of local demand on existing resources could be relieved required the ready availability of imported timber and the items for which wood-based equivalents were substituted in the traditional economy. Such a transformation required a broadening of the economic base and a major improvement in communications; it has already been noted that neither had taken place by 1850 (above, 2.5). At this date the domestic use of woodland in many parts of Perthshire and Argyllshire was therefore little different from that of 1750; the development of external markets for bark and timber restricted the availability of materials for local use but seldom offered any form of compensation.

It cannot be certain whether or not there was any significant change in the level of consumption of local woodland produce per household and the efficiency with which it was used, although it may be suggested that a rise in consumption was balanced to some extent by improved

supervision of woodland and improvement in working methods. The increase in population perhaps increased pressure on resources. Population totals and densities have already briefly been described. It is probable that the total population of most parishes in the two counties increased slowly and irregularly at least until 1800. Only after that date is there evidence of a decline in population pressure on woodland resources; by 1831 the populations of most parishes had passed their peaks (above, 2.5).

The varied nature of demand for woodland produce suggests that physical damage took a number of forms. In some cases mature trees were felled; at other times the careless cutting of branches exposed trees to disease and the stripping of bark led to the death of standing trees. Damage of this type probably also contributed to the failure of regeneration; reduction in the number of healthy mature trees would reduce the quantity of seed available and regenerative growth could also be damaged or destroyed by ground disturbance during felling and the regular movement of those searching for the smaller forms of material.

Damage of this type was almost invariably associated with damage by domesticated grazing animals, and it is not possible to isolate the effects of direct human use. Human action was responsible for the destruction of individual mature trees, but both forms of damage affected regenerative potential, and it is probable that persistent and intense grazing pressure was a more effective means

of inhibiting regeneration. The application of ecological techniques to present woodland communities may permit distinction between the effects of these agents in relation to comparable pastoral societies, but evidence is not available in a form which allows evaluation of the relative importance of these gradual and interrelated processes in the past. The effects of the demand for woodland produce are therefore inseparable from grazing, and it is necessary to examine the role of grazing stocks in the economy of Perthshire and Argyllshire.

3.9 Summary

In Scotland legal ownership of woodland rests with the landowner. Tenants in Highland counties were generally allowed use of woodland as a privilege rather than a right. In Perthshire and Argyllshire the use of woodland was controlled by local convention supported by local and national statute. There is no firm evidence of uncontrolled use of woodland on an extensive scale but the methods of control employed were at times inadequate and frequently abused.

The limitations of resource encouraged the use of woodland produce in a large number of ways. Large timber for construction was perhaps the most important requirement but small timber, brushwood, leaves and bark were also employed, as were bog timber and driftwood. Commercial demands reduced the quantity available for local

use and led to stricter control; they may also have encouraged the selective felling of birch and alder for local use, but these species in any case had intrinsic value for certain purposes.

It is not possible to estimate the level of demand for woodland produce in the two counties, but increased pressure is likely to have accompanied the overall increase of population in both counties until the early nineteenth century. Woodland was damaged by the destruction and mutilation of mature trees, and both direct and indirect reduction of regenerative ability; the effects of non-commercial use of woodland produce cannot be separated from those of grazing in contributing to the decline of woodland.

CHAPTER FOUR

NON-COMMERCIAL USES OF THE WOODLAND AREA

4.1 Introduction

The protection and management of woodland was a form of improvement which had little direct effect on the local community; it required little capital and did not necessitate radical social or economic change. If woodland was enclosed permanently or over long periods, however, the indirect effects could be very marked. The form of pastoralism characteristic of the Highlands was marginal to the extent that it relied on the use of certain proportions of land of different qualities; a change in the area available in one category might have a disproportionate effect on the viability of the farm as a whole. A definite reduction of the area available for certain purposes might make necessary radical changes in the system of agriculture.

In Perthshire and Argyllshire, as has been seen, woodland was typically distributed along valley and shore lines and on the lower or more sheltered slopes (above, 2.4). The vast areas of exposed upland, which carried little of the woodland, were of value primarily as summer pasture; most agricultural activity was consequently concentrated

on the same low and sheltered terrain most suited to the growth of timber. The community required as much land for tillage, hay, winter pasture and other land uses as was available; much of the woodland of the Highlands was therefore in a position where its existence had to be reconciled with the interests of other demands on land.

The principal activity competing with woodland for space was pasturage, and the two land uses were compatible to the extent that they could be carried on in the same area of ground. Most Highland woodland communities have underlying strata of shrubs and herbaceous plants acceptable to grazing stock. In dense pinewood this vegetation may be relatively sparse and impoverished in species, but in more open stands of pine the underlying layers tend to be more fully developed and in woodland dominated by birch and other deciduous species they are generally richer in species (McVean & Ratcliffe (1962) 11-18). There are no grounds to suppose that in general terms the ground vegetation of Highland woods was formerly substantially different and less attractive to grazing animals; the shelter provided by trees was in any case an asset which compensated for any deficiency in the quality of pasture under woodland.

Unfortunately, the effects of grazing could at best be of limited value in the management of timber. Light pasturing is occasionally employed in modern forestry, but only in certain circumstances and under close super-

vision (Ellice (1968) 321-2). In semi-natural woodland maintained principally by natural regeneration the benefits of grazing are outweighed by the disadvantages. All domesticated grazing animals may damage trees if given access to woodland. Young timber, seedlings and coppice shoots may be eaten or trampled, and natural regeneration will therefore be retarded or halted; mature trees may be harmed by the gnawing or rubbing of bark and low branches. Under severe and sustained grazing pressure the life of an area of woodland is no greater than that of the youngest established tree, and the value of the surviving mature trees may also be reduced.

4.2 Grazing regimes in the traditional Highland economy

The use of land as pasture was controlled to some extent by parliamentary statute, which was interpreted, modified and applied in accordance with local usage by local courts; such statutes were concerned primarily with the protection of plantations and other enclosures. An act allowing proprietors to take action against those who grazed animals in their enclosures without permission was passed in 1607 and modifications were made in 1661 and 1685. The act for winter herding of 1686 required that animals should be herded both in winter and in summer and kept indoors at night, because so much damage had been done to plantations and enclosures by unsupervised winter grazing (APS V.4 (1816) 373, V.7

(1820) 263, V.8 (1820) 488, 595). Such legislation almost certainly had very little direct effect; the act for winter herding was still unevenly observed at the end of the eighteenth century (Marshall (1794) 16, Allardyce, ed. (1888) V.2, 201). The form of the grazing regime and the pattern of areas pastured was left to be determined largely by local custom and the decisions of proprietors expressed through their courts.

A number of factors were sufficiently uniform throughout the two counties to render the grazing regime relatively consistent. It was necessary that the growing crop should be protected against damage through the period between sowing and harvest, which might extend from April to early November (Gailey (1963) 106-7). Careful herding of stock and the use of temporary fences could give some protection, but the amount of pasture available at low levels was limited. The accessibility of hill pasture suitable for use during the summer season provided a convenient means of grazing the stock out of range of the growing grain, and at the same time permitting the conservation of low grass for hay or for direct grazing at the end of the season. The whole grazing stock could not be left to forage on hill pasture during the summer six months; milk, butter, and cheese were vital to the health of the community and it was therefore necessary that the milk cattle should be accessible through the season. In general the sheep and goats, known collectively

as 'small cattle', and the barren or 'yeld' cattle were pastured on the upper hill grazing, but the milk cattle remained near the permanent settlement, on the lower and more attractive grazings.

A form of transhumance allowed pressure on these areas to be relieved by the use of shielings. This term was at times used to describe hill grazing as a whole, but it referred more specifically to sites used annually as temporary grazing bases; they were generally isolated from the permanent settlement and often at relatively high altitudes (Campbell (1752) 16-17). The milk cattle, sheep, and goats were customarily taken to these sites for a few weeks and milked for butter and cheese; shielings were commonly employed for a period of approximately six weeks in June and July (Innes, ed. (1855) 364, Grant (1919) 147, Gaffney (1960) 26). They were not always at high altitudes; although in central Perthshire shielings reached 2,000 feet (610 m) in altitude, they were on the shore on the island of Jura (Pennant (1774) 216, Millar (1967) 207). They were not an indispensable part of the grazing resource; in some areas such sites were rare, and pasture more than ten miles (16 km) from the farm might be used (Campbell (1752) 16-17). On some estates not all tenants possessed shielings, and in other cases hill grazing remained in use by tenants after shielings were abandoned (Marshall (1794) 45, Anderson (1967) V.1, 340).

The traditional dates for the movement of small and yeld cattle to and from hill grazing as a whole were the festivals of Beltane and Samhain, on May 1 and November 1 respectively, and there is evidence of the employment of these dates at different times and places during the period (Innes, ed. (1855) 364, MacSween (1959) 84, Grant (1961) 66); milk cattle moved to the hill later, remained at lower altitudes, and returned earlier. In some cases the movement of stock during summer was fixed by regulations or custom;under government administration the livestock of the estate of Struan moved according to a detailed timetable (SRO E.788/20/1, E.788/20/4). In the winter half of the year it was not necessary to protect crops against grazing, and the stubble was available as fodder. The beginning of the summer regime was clearly stated in the Struan regulations but the sequence of movements ended indefinitely in late summer; each farm was required to have a 'hill poindler' to supervise grazings and prevent encroachment after March 1 and a poindler on low ground after May 1, but these officers were not thought necessary in winter (SRO E.788/20/4).

Wintering was almost certainly the greatest problem in the grazing economy. After the late harvest large areas of hill pasture were of little value; the vegetation was able to sustain only those animals capable of ranging rapidly over wide areas, and the exposed upper slopes were not a safe wintering ground for domesticated

stock. Even red deer, although adapted to a mountain habitat, still winter if possible on sheltered ground with access to valley grass and agricultural land, especially when snow is lying on the upper pastures; the extent and quality of wintering is probably the primary determinants of the carrying capacity of land for deer (McVean & Lockie (1969) 66, Mather (1972) 42-4). Only the lowest hill pasture and the land within the head dyke was of consistent value, and this wintering range was disproportionately small in relation to summer pasture. The use of hay and other fodder was limited, and the methods of winter feeding and seasonal movement between districts later developed by large-scale sheepmasters were not practicable in the old Highland economy (Watson (1932) 8, Carlyle (1972) 105-7).

All land of value as wintering was under considerable pressure; the number of animals could be reduced by sale and slaughter at the end of summer, but only to a limited extent. Black cattle were the only reliable source of cash both for proprietors and tenants in the traditional economy (Gray (1957) 142, Smout (1963) 24). Producers required as large a winter stock as could be maintained to utilise the hill grazing of the following summer adequately; tenants owning a few head of cattle were also disproportionately likely to suffer hardship as the result of severe winters, accident, disease and reproductive failure. If the stock at the beginning of winter was

within the range which the available pasture could support comfortably, the number would be small and could be seriously depleted by the less predictable hazards.

Rennie noted that in the Highlands as a whole more animals were usually wintered than could adequately be fed, and it is likely that in general the number of beasts retained by tenants in Perthshire and Argyllshire was set at or above the maximum number which local experience indicated to be capable of surviving an average winter (Rennie (1814) 398). In such a case a high mortality rate would be predictable even in normal conditions, and it has been estimated that in the early eighteenth century the average winter mortality rate of Highland cattle stocks was about twenty per cent (MacLagan (1958) 66-7). Rennie estimated that in a hard winter with heavy snowfall thirty to fifty per cent of the stock might die, and the rest would be too emaciated for profitable sale (Rennie (1814) 398).

The total number of grazing animals in a district was fixed by a system of souming; the soum or sowm was basically the grazing area estimated to be sufficient to support a given number of animals. Handley has suggested that the basic soum was the grass for a mature cow; four or five sheep were equivalent but a horse required two soums (Handley (1953) 100). In the legal process of sowming and rowming the ratio was taken as ten sheep per cow, but in Balquhidder in Perthshire about 1800 a horse

was reckoned equivalent to two cows or eight sheep (OSAS V.6 (1793) 93, Bell (1838) 773). There is evidence that other ratios were employed, which suggests that each district adopted a local standard; thus Burt noted that near Inverness in the early eighteenth century the soum was grazing for four sheep or twenty goats, but that two soums were required for a cow and a half (Burt (1754) V.2, 139).

Souming arrangements were necessarily flexible; they were generally based on proportions of sheep and cattle, but allowance was made for the requirements of animals of different ages and types and tenants with only a small share of the total area could not be expected to graze only one form of livestock (SRO E.788/20/4). A tenant's soum was related to the size of his holding and souming was supervised by baron court officers or constables on the summer grazing (MacSween (1959) 85, Smout (1969) 130). The legal process of sowming and rowming allowed the division of common pasture among proprietors holding servitudes over the land; the criterion of division in this case was the relative wintering capacity of their lands (Bell (1838) 773). It is likely that this principle also underlay the less formal local souming arrangements.

Souming controlled the level of grazing on the summer pasture. Limitation of the permitted summer total would encourage tenants to restrict the number of animals retained at the beginning of winter to the permitted soum, with an additional number to compensate for winter losses.

If a mild winter allowed an exceptional number of beasts to survive, however, it is unlikely that tenants would willingly lose this benefit. When contemporary observers reported that summer pasture was overgrazed, they almost certainly meant that the stock exceeded the number permitted by local regulations; it has been suggested that the recognised deterioration of Highland hill pasture is in fact the result of persistent understocking in terms of carrying capacity (Ryder (1968) 155).

The number of animals which could be wintered therefore determined the stocking level of summer pasture. In 1814 Rennie estimated that in the Highlands as a whole summer resources were used only to ten per cent of their capacity; even now the efficiency of hill farming in the Highlands is greatly restricted by the disparity between summer and winter resources (Rennie (1814) 398, McVean & Lockie (1969) 51). In the Cairngorms and perhaps in other areas the illicit summering of lowland or 'gall' cattle provided an additional income for small tenants, but in general only local stock appears to have been grazed (Gaffney (1960) 13-15). Despite proximity to lowland areas, there is no evidence to indicate that such a practice was employed to increase the use of summer pasture in northern Perthshire.

In most areas the disparity between wintering and summer pasture was probably too great to permit reduction in pressure on resources even by large increases in the

wintering area; any change in extent would sooner or later be followed by a corresponding increase or decrease in stock numbers. An approximate constancy of relationship would therefore be preserved between the number of animals at the beginning of winter and the area available, based on the expectation that in normal circumstances a certain mortality rate was inevitable. In such a case it was necessary that wintering should be fully utilised, primarily by direct grazing. Fodder crops were of limited importance and used mainly when snow lay on the low ground or in the later part of the season when accessible ground vegetation was exhausted (Smout (1969) 131).

The animals ranged freely during the day over grass, stubble, and other available vegetation; even after 1800 it was general for cattle to be controlled by herding only in the growing season and harvest (Walker (1812) V.1, 101-2). The freedom of movement of stock was limited only by the custom of enclosing or bringing indoors some of the animals during the night (Marshall (1794) 16, Robertson (1794) 69); the milk cattle were given preferential treatment and the small Highland sheep were also generally housed for part of the winter (Grant (1961) 75, 79). At the end of winter came 'lifting day', a customary date at which the enclosed stock were carried or assisted to the first spring growth; after an exceptionally harsh winter cattle in north Perthshire might still be weak in early June (SRO E.783/60/257(1), Grant (1961) 75, Smout (1969) 131). Other animals were wintered outdoors; Rennie

observed that in the Highlands as a whole few tenants could accommodate their whole stock and that death from exposure was common (Rennie (1814) 397-8). Nor were unaccommodated animals always penned at night and retained on the lower pastures.

Goats and the semi-feral small horses characteristic of the Highlands were often left to fend for themselves in winter. Thus in the early eighteenth century Breadalbane tenants gathered and milked goats on shielings in the forest of Mamlorne, but allowed them to range the uplands with the horses in winter (Greig (1970) 8,15). Some of the yeld cattle were also left to find their own wintering. In 1781 the pinewood of Rannoch was said to be endangered in winter by most forms of cattle; stock was not commonly housed in the district and groups of animals from remote farms gathered round any area of enclosed pasture (SRO E.783/76/11). As noted earlier feral grazing animals in Scotland, including both deer and goats, tend to winter in shelter and on low ground, especially woodland (Greig (1970) 203, McVean & Lockie (1969) 66). It is therefore probable that deer, goats, horses, and other free-ranging domesticated animals spent much of the winter on the low ground.

4.3 Composition of the grazing stock

In the old economy the grazing stock consisted generally of cattle, sheep, horses and goats; pigs were rare

and the object of superstitious dislike in some areas (Grant (1961) 87). Possession of cattle provided social prestige and cash for regular and exceptional outlays; dairy produce was at least as important in the diet as the produce of cultivation, and even the smallest sub-tenants were generally allowed cow grass (Gray (1957) 22, Symon (1959) 96). The difficulties of wintering affected the health and growth of the stock. Although hardy and rapidly fattened on poor pastures, black cattle were abnormally small and required four years of feeding before being fit for sale; cows did not calf every year and the milk yield was low over a short lactation period (MacLagan (1958) 66, Grant (1961) 75). Traditional sheep were also very small and considered to be frail; the meat was of high quality but their value was principally domestic, as a source of meat and exceptionally fine wool (Grant (1961) 79).

For reasons outlined above souming ratios do not provide a reliable indication of the composition of stocks (above, 4.2). Gray considered that sheep were equal in number to cattle or slightly more numerous throughout the Highlands in the middle of the eighteenth century; in regional terms and on individual holdings cattle always formed between thirty and fifty per cent of the total number (Gray (1957) 38). Other estimates indicate similar proportions, although cattle may have been less important in Perthshire than in Argyllshire, where the production of cattle for sale was especially important in

the north and the islands (Darling (1955) 167, MacLagan (1958) 64-6, 70, Grant (1961) 79, Gaskell (1968) 17n). The commercial importance of cattle developed largely after 1700 and they may in general have been less important in relative terms before that date (Grant (1961) 65-9).

The ratio of cattle to sheep is not an adequate measure of the whole grazing stock. Sheep and cattle were certainly important but they were not the only animals commonly grazed, and the number of horses and goats was considerably larger than is perhaps generally realised. Small horses or garrons were used in ploughing, other agricultural purposes, and tasks such as the performance of carriages as service. The number retained was large in relation to their value throughout the year; the heavy seasonal demands of ploughing and peat transport required more work-horses than were otherwise necessary, and some observers thought that overstocking was general (Gray (1957) 40-1, Rennie (1814) 398). When not required garrons were in general grazed on the hill pasture, and they were sometimes incompletely domesticated, being caught and broken for work only when necessary (Gray (1957) 40-1). The terms 'hill horse' and 'bog mare' applied to such animals in Perthshire indicate their semi-feral nature (SRO E.788/22/4, Greig (1970) 15).

For a number of reasons the importance of goats has been largely underestimated or ignored. A partial explanation is that the species is assumed never to have been

important; it no longer has a secure place in Scottish agriculture and is represented mainly by a small feral population in the more remote uplands and islands. A more substantial reason, however, is that there is much less contemporary evidence relating to the use of goats than can be found referring to other forms of livestock; the silence is explained to some extent by the circumstances which gave goats a definite role in Highland agriculture. The prime value of the goat was as a source of meat and milk in a subsistence economy; the meat was palatable but not widely marketed and only the skins were of a definite commercial value. Goats were therefore seldom specifically mentioned as a component of rent (Campbell (1965) 185). The humble role of the goat in the agricultural system ensured that it was seldom mentioned in estate documents; much of the information available comes from the records of travellers who were surprised to find the animal in large numbers.

The value of goats as milk producers was considerable. The yield per head was double that of ewes and the milk was frequently made into cheese, which was at times marketed (Ray (1746) 349-50, Johnson (1775) 129-30); goats kidded a month or more before lambing began and goatmilk was a valuable part of the limited spring diet (Boswell (1785) 144-5, Carruthers (1843) 235-7). Goat-flesh was also of some value; in Kintyre and Arran many of the sheep and goats were killed at Michaelmas and

salted for winter provisions (Pennant (1774) 177, 194, Campbell (1802) V.1, 223). A certain amount of goatflesh was sold in the markets of the Highland fringe through the eighteenth century (Burt (1754) V.1, 78, Boswell (1785) 144-5, OSAS V.10 (1794) 617); there was also an internal trade in goatskins, which were used as containers for liquids (Martin (1703) 205, Pennant (1771) 162).

Goats had additional advantages as part of the grazing stock; they were able to crop more closely than other animals and ate a range of species refused by sheep and cattle (Greig (1970) 206). They were therefore grazed in some cases on lands from which sheep could no longer extract nourishment (Burt (1754) V.1, 219). Goats were also able to pasture areas of hill land thought to be too dangerous for sheep and cattle or inaccessible to them; the grazing of goats on such ground allowed more efficient use of resources, permitting reservation of the better pasture for the less agile animals. This advantage was utilised before 1750 by early improvers in Argyllshire such as Campbell of Knockbuy (Campbell (1965) 184). It was also cited by later writers as a reason for retaining goats in a changed economy (Campbell (1802) V.1, 223, Heron (1806) 346, Carruthers (1843) 235-7).

A belief in the curative powers of goats was established in Gaelic culture and Britain as a whole until recently; grazing or housing of a few goats with other farm animals was held to cure or prevent certain diseases

(Forsyth (1900) 321, Campbell (1965) 182-3, Greig (1970) 9). There seems to be little foundation for Megaw's assertion that possession of goats carried a social stigma and was associated with subtenancy in the old Highland economy (Megaw (1963) 207). There is evidence of the keeping of goats by chiefs and tacksmen. Thus in a stock raid on Glen Lyon in Perthshire in 1689 the laird lost a number of goats, although a smaller proportion than his tenants (Campbell (1886) 53). As late as 1783 the duke of Argyll's tacksman of Liddesdale in Sunart kept sixty goats contrary to the terms of his lease (Cregeen, ed. (1964) 120).

There is some evidence of the use of specialised shielings for goats alone. On the coast of Jura Pennant saw conventional shielings with milk cattle and also a group occupied by herdsmen tending a flock of eighty goats (Pennant (1774) 216). In 1803 Dorothy Wordsworth saw the remains of a shieling hut at the head of Glen Gyle in southwest Perthshire; according to her guide it had formerly been used by a family as summer pasture for goats (Shairp, ed. (1874) 228). Separate goat shielings may have been intended to prevent damage to the hill pasture used by the more valuable animals; a number of the smaller islands of Argyllshire bear the name 'Eilan nan Gobhar' (Island of the Goats), and there is some reason to believe that goats were in fact summered on these islands (Megaw (1963) 201, 208).

During the eighteenth century goats were also kept

in some areas in connection with the goatmilk and goat-whey cure for pulmonary diseases. The cure developed some of the characteristics of spas; certain centres became fashionable summer resorts at which the therapeutic value of the milk was secondary. There is some evidence of the use of goatwhey as a cure in the period after 1715, and by 1752 it could be observed that many of the gentry summered in the Highlands for that purpose (Campbell (1752) 19, Burt (1754) V.2, 127, Forsyth (1900) 326). South central Perthshire was a principal centre; Sir John Clerk was at Dalguise for goatwhey in 1742 and after 1770 the cure was recorded in and around Callander, Crieff and Dunkeld (Pennant (1771) 76, Newte (1791) 250, Craven, ed. (1886) 321, Lukis, ed. (1880-7) V.3, 423). The cure was also carried out in the Ochils and in other parts of upland Scotland, but declined at the end of the century in face of rival attractions such as Pitkeathly Wells and was apparently largely extinct by 1800 (Heron (1793) V.1, 45, Marshall (1794) 43, Greig (1970) 7-8).

The number and distribution of goats is not easily assessed; there is a general paucity of information about the earlier period and estimated totals are not always reliable. There can be no doubt, however, that goats were kept in large numbers in the seventeenth century. Smout found that Scotland exported about 16,000 goatskins per year in the early seventeenth century and 50,000 per year by 1700, with a peak of 57,000 goatskins and 43,000

kidskins in the famine year of 1698 (Smout (1965) 187). Goats were not common in the lowlands, and although some of the exports may have been from Galloway Spreull's description of them as 'wild skins' suggests a Highland origin (Spreull (1705) 1-2, Greig (1970) 7). Information about the numbers kept and the ratio of sheep to goats on individual estates and farms suggests that large populations were retained in some areas after 1700.

In 1698 seventy-four goats were stolen from the possessors and tenants of two farms in west Perthshire, and in 1727 twenty were taken from a single tenant in north Argyllshire (Cameron, ed. (1949) 164-5, Imrie, ed. (1969) 392; Megaw suggested that the middling tenants of north Argyllshire kept stocks of between twenty-four and thirty-six goats (Megaw (1964) 215). The soums of established tenants on the Locheil lands about 1750 included one hundred goats for every sixty or eighty sheep (Megaw (1964) 215). There is less evidence about central and eastern Perthshire, but goats were equivalent in number to between forty and seventy-five percent of the sheep stolen from Glen Lyon in 1689 (Campbell (1886) 53). Such evidence indicates that goats retained a firm place in the agricultural system; Smout has suggested that the seventeenth-century goat population expanded in the Highlands as a whole as did the tenant population, and this may have continued locally after 1700 (Smout (1969) 188).

When it occurred the reduction of the domesticated

goat population was thorough and relatively rapid. Large numbers were recorded around Blair Atholl in 1747 and 1762 but very few survived in 1791 (Anon. (1747) 118, Craven, ed. (1886) 142, OSAS V.2 (1791) 467). The parish of Ardgour (or Kilmallie) was estimated at the end of the eighteenth century to have 1,000 or 1,500 goats, but they were scarcely known in the district by 1845 (OSAS V.8 (1793) 424, Smith (1805) 282, NSAS (1845) V.14 (Inverness), 120). Decline appears to have occurred generally after 1750 and rapidly after 1770. In 1752 they were still said to be abundant and in 1770 Bishop Forbes saw huge herds near Kinlochleven and Loch Tulla (Campbell (1752) 7, Craven, ed. (1886) 318-9); by the end of the century, however, a general and extensive reduction was reported throughout the southern and central Highlands.

They had almost gone from Perthshire and upland Angus (Marshall (1794) 43, Robertson (1794) 69, Headrick (1813) 449-50). Inverness-shire and Argyllshire were the counties in which goats remained most abundant, and even there populations were much reduced; no more than ten thousand were thought to survive in the two counties, excluding the Argyllshire islands, for which no estimate is available (Smith (1805) 282, Robertson (1808) 260-1). This was probably an underestimate, and some allowance must be made for the islands of Argyllshire which at present contain almost half of the Scottish feral goat population (Greig (1970) appx. i-iii). Even if the

estimated total for the two counties were doubled to compensate for this, the number would still be small in relation to previous populations and the number of sheep introduced; after 1790 the single parish of Ardgour was said to contain 60,000 sheep (OSAS V.8 (1793) 424).

There is some evidence that goats were more common in Argyllshire throughout the period. Most of the evidence relates to Argyllshire and the western part of Perthshire and there are few indications that large populations were present in eastern Perthshire after 1650. This tendency seems to have been accentuated as numbers decreased; over fifty per cent of the surviving feralised goats are in Argyllshire and less than one per cent are in Perthshire; the total Scottish population in 1969 was estimated to be no more than 3,900 (Greig (1970) appx.i-iii).

4.4 The effects of grazing on woodland

Woodland was an integral part of the grazing resource unless deliberately reserved and protected; the strong seasonality of the grazing regime governed the value of woodland as pasture and the pressure to which it was subjected. During the summer season woodland below the head dyke was largely free from direct grazing. Milk cattle and other animals retained on low ground for part of the season were generally herded or tethered; use of low-lying wood as pasture was therefore largely confined to a small part of the stock, under some form of control.

A certain amount of woodland on other sites was exposed to a larger part of the grazing stock during the summer. As shall be seen later, cattle were in some circumstances pastured in woodland through most of the year (below, 4.5). Shielings were not necessarily oases of good pasture on bare upland and in some districts shielings and woodland formed an interwoven pattern (Adam, ed. (1960) 5-8).

Trees covered only small parts of an extensive upland area which was generally undergrazed, and the easy availability of more palatable vegetation reduced the danger to mature timber and bark; cattle used woodland as shade in summer but were said to prefer the grazing of open conditions (Walker (1812) V.1, 323-4). While resting in shade, however, cattle tended to rub or gnaw bark and accessible branches (Brown (1861) 58); it was also possible that seedlings and shoots within woodland and beyond the woodland edge would be damaged. New growth within woodland was liable to be damaged by the movement of animals seeking shade or shelter and the grazing of upland pasture occurred during the growing season, when seedlings were most palatable and vulnerable to damage.

In addition, the areas of open upland which are now most suitable for colonisation by tree species tend also to have strong attractions for grazing animals; the best upland sites for regeneration are usually in valleys and gullies or on the woodland edge, areas which are commonly used by grazing animals for shelter and as routes (Pears

(1967a) 828). Tansley recognised that grazing was associated with the lowering of the tree-line and inhibited regeneration outside existing upland wood (Tansley (1939) 454-5). It may be noted, however, that damage to upland wood may in part have been caused by deer and the hardier farm animals seeking shelter in winter, especially if they were excluded from lower woodland areas.

The use of low pasture as the main source of feed during six months of the year ensured that unprotected and low-lying woodland was part of an area grazed intensively by a relatively large stock of undernourished animals. Deciduous species in particular provide less edible growth in winter, but stock deprived of other vegetation will not refuse deciduous and coniferous seedlings, saplings and bark; coppice shoots and other young growth are also vulnerable. Even in the controlled grazing by sheep of established coniferous plantations it is advisable that there should be adequate ground vegetation, and that animals should not be admitted while hungry or during periods of snow cover (Ellice (1968) 321-3).

As already indicated, grazing animals tend to use woodland extensively in winter for shelter and feeding. Walker noted that cattle refused woodland vegetation in summer but accepted much of it while sheltering in winter (Walker (1812) V.1, 323-4). When snow fell on the upland pastures the feral and domesticated animals grazing on the

upland descended to the shelter of the valleys; when snow lay in the valleys themselves any vegetation projecting above the surface, including bark and young growth, was endangered. In normal winters woodland was subject to browsing and cropping of young growth, gnawing of bark and low branches, and the trampling of seedlings; in harsh seasons damage to unprotected wood may have been severe.

A form of poor natural hay provided a small amount of additional fodder; in some cases sections of low meadow were enclosed for much of the summer and cut for use in winter, but hay was also derived from coarse grasses, rushes and broom, supplemented by heather and straw (Gray (1957) 37, Anderson (1967) V.1, 340, Smout (1969) 131). The grass of enclosed woodland was sometimes cut as hay, but such a practice was dangerous to seedlings and shoots among the long grass (Edlin (1956) 84-5); cutting and shearing were penalised under the forest laws and an act of 1607 prohibited the shearing of grass within wood enclosures (APS V.1 (1844) 690, V.4 (1816) 373). In 1769 hay was still being cut among the scrub on the shores of Loch Tay; a wood was kept specifically as meadow at the east end of the loch but the atmosphere among the trees was too damp to allow drying on the site (MacArthur, ed. (1936) 47, 169). Similar difficulties in drying the poor grass of clearings in coppice were reported in Dunbartonshire after 1800 (Whyte & Macfarlan (1811) 157).

The condition of woodland was also affected by the composition of the grazing stock. There is some difficulty in apportioning responsibility for damage; the generic term 'cattle' was used to describe the whole domesticated grazing stock. Cattle in the modern sense were probably the least destructive of the Highland grazing animals; their relatively great importance in the old Highland economy may have been beneficial to woodland, if only in reducing the rate of decline. Black cattle were at times included among the animals blamed for damage to wood in the Highlands as a whole, but there is little unambiguous evidence of damage caused specifically by them (Walker (1812) V.2, 284). They were not totally harmless, however, and nineteenth-century foresters were not willing to permit cattle to graze in managed woodland without careful supervision (Monteath (1824) 144, Brown (1861) 59, Gilchrist (1874) 126).

Sheep tend to crop more closely than cattle and to strip the bark of certain tree species (Ellice (1968) 321-2). Traditional Highland sheep may also have been more agile than modern varieties, which are encumbered by large fat deposits; Greig has suggested that sheep were not markedly less destructive than goats, and in some parishes both goats and traditional sheep were banned from the low ground before 1800 (Greig (1970) 5, 209, below, 4.5). Their destructive role may have been reduced to some extent by the custom of folding at night and herding or tethering

during the day (Grant (1919) 147, Grant (1961) 79). No such control was employed when lowland sheep were introduced. Shortly before 1800 Marshall claimed that the whole lowland area of north Perthshire was overrun by sheep in winter; in Dunkeld parish the sheep grazed on the hill in summer but wandered through the unenclosed arable and woodland between harvest and spring (Marshall (1794) 16, OSAS V.20 (1798) 468-9).

The role of horses requires clarification, and little information is available; this may result from the semi-feral condition in which hill horses were commonly kept. Contemporary opinions about the safety of grazing horses in wood varied considerably. In 1783 the general supervisor of woods on the annexed estate proposed that a hundred bog mares should be pastured in the new enclosure of the pinewood of Rannoch, as horses did no damage; the factor was willing to accept twenty but thought that a larger number would trample the young pines. Having read both opinions, the commissioners decided that no stock of any kind should be admitted (SRO E.721/27, 75, E.788/22/4). Some contracts for the sale of coppice in Perthshire allowed horses to be grazed in young coppice growth earlier after cutting than other farm animals (SRO GD.220 [Wk.12]).

Goats were the most common subject of observations on damage to woodland when these were directed at a specific type of stock. In the old economy goats were

subject to little control and their feeding habits were probably similar to those of their feralised descendants. Feral goats will when necessary eat a wider range of vegetation than sheep but they are more selective in preferring trees and shrubs when these are available; they will bark certain conifers and hardwoods at any time of year. They are also selective as individuals in choosing to eat only certain forms of vegetation for periods during the day; they are able to stand on their hind legs and climb leaning trunks. Unlike sheep, goats move in compact herds and cover a large area as a group during the day, browsing on the move; they prefer to winter on sheltered and wooded ground (Greig (1970) 203, 206-10).

These feeding habits may have made goats useful to their possessors; their mode of life and their hardiness made them to some extent complementary to sheep. The same habits made them undesirable if woodland was to be protected; their agility and fondness for bark became serious disadvantages. Pennant saw goats on the sides of Loch Fyne standing upright to strip branches, and in mid Argyll they were to be found using branches to climb within reach of the higher bark (Pennant (1771) 168-9, Robson (1794)69). Where tanbark coppice was established damage to wood could be calculated in monetary terms; thus in 1740 goat damage to the Montrose woods of Menteith was assessed in measures of bark, which could at the time readily be converted to cash values (SRO GD.220 [Wm.18]).

The ease with which goats negotiated walls and fences secure against other stock made banishment the most practicable expedient. A proposal of 1708 that the woods of the regality of Atholl should be protected by goat-proof fences was a vain hope (EUL Dc.I.37 1/3, 12); the expense of erecting and maintaining such fences could be avoided if the offending animals were removed. Most proprietors eventually appear to have reached such a conclusion. Goats were forbidden in parts of south Argyllshire in order to protect young trees and the crop of coppice bark; damage to bark was considered to be a major reason for their disappearance from north Perthshire, and as shall be seen later the increased importance of woodland management was a general reason for their decline (Robertson (1794) 69, Megaw (1964) 214, below, 4.5).

4.5 Grazing and the management of woodland

The value of pasture in woodland was a major obstacle to the enclosure and protection of woodland for timber or bark; proprietors interested in the systematic protection and management of wood were compelled to resolve in some way the conflict between grazing demands and their desire to reserve land exclusively for the growth of trees. Little outlay might be required for the enclosure of woodland but the curtailment of the wintering supply made it inevitable that the winter stock should be reduced to some extent. It was consequently necessary that the number of

tenants should be reduced or that reductions should be made in rents to compensate for the loss of carrying capacity. In either case the proprietor's income from rent was reduced unless the increased commercial value of the wood was sufficient to balance the loss of grazing rent.

The value of the protection of woodland was intangible. Trees could be seen to grow and reproduce without aid, and even if it were realised that grazing damaged timber the extent of deterioration could not be measured accurately. It is not therefore surprising to find that until external markets for Highland timber and bark developed the restriction of grazing in woodland was uncommon and limited in extent. Even when wood management for commercial purposes was at its highest stage compromise was thought necessary to revolve the conflict of interests which had previously been latent and was now unavoidable. The most general compromise was the protection of woodland only during a period when young growth was thought to be most vulnerable. This principle could only be applied effectively to coppice cut in regular sections and plantation. Casually cut coppice and wood dependent for survival on irregular natural regeneration required complete protection or constant vigilance to protect the parts in which regeneration was taking place; thus the timber least likely to be well managed for profit needed methods of protection which were in general applied only when woodland was already of commercial value.

There was a considerable range of relationship between management and grazing in the seventeenth century, although information remains fragmentary and conclusions must be subject to the reservations expressed above (above, 3.2). The coppiced wood of Kincardine in south Perthshire was carefully enclosed; the forester was allowed to graze a certain number of animals by his commission of 1656, but the pasture of cut coppice was excluded from use until the timber had grown beyond the need of enclosure (SRO GD.220 [Wk.2]). In contrast to this, the regulations of the baron court of Glenorchy controlled cutting rigorously but made no provision for the protection of natural wood against grazing (Innes, ed. (1855) 352-66). This may be compared with an example relating to an Aberdeenshire estate which illustrates the degree of control shown by the more enlightened proprietors in the seventeenth century. In the barony of Forbes illicit grazing was repeatedly punished; when the grazing of enclosed woodland was leased the conditions of the tack allowed the proprietor to terminate it if there were signs of damage to the timber (Thomson, ed. (1919) 276-7n). Efforts were also made to protect young natural growth which had as yet no commercial value; in 1665 tenants were ordered to keep their stock away from '... ye birkes of Windis Eye or quhair yair is any apperance of birk or saplenes or any other timber is lyk to grow', both in winter and in summer (Thomson, ed. (1919) 259-60).

In these cases management was probably concerned largely with plantations of limited size. The expansion of trade in coppice produce in the eighteenth century led to the management as coppice of large areas of semi-natural woodland which had previously been available for grazing. By the end of the eighteenth century proprietors in Perthshire and other parts of the southern Highlands had adopted a system in which rotations were between nineteen and twenty-five years in length and each section was enclosed for six or seven years after cutting; during the remaining twelve years or more of the rotation the pasture was available to the tenants (below, 7.6). Only a few areas of coppice are known to have been permanently enclosed and completely free of grazing during this period (Whyte & Macfarlan (1811) 152). In parts of Argyllshire, coppice was cut in blocks on a rotation of nineteen years and the whole coppice area of an estate, if protected, was unavailable as wintering for six or seven years of the period (Smith (1805) 141).

If a wood was cut on a regular twenty-four year rotation of equal sections enclosed for six years after cutting, slightly more than seventy per cent of the area was available for grazing at any time, as one section was being cut and six others were enclosed; block cutting did not allow the distribution of enclosure costs through the rotation. Enclosure for only six or seven years was understood to be a compromise between conflicting interests, and it was gen-

erally agreed that a longer period was desirable (below, 7.5). Plantations were enclosed initially for periods as long as twenty years, but could then be opened for grazing under supervision until they were felled.

In some cases a cash rent was available for woodland grazing; in the later part of the period the wintering of Highland stock in the plantations of the marginal areas was a useful source of income (Headrick (1813) 376). The value of grazing land was also manifested in the granting of abatement or rent reduction to tenants whose holdings were temporarily or permanently curtailed by enclosure. When the duke of Argyll's woods in Morvern were surveyed in 1786 it was found that on several farms woodland separated the upland pastures from the land by the shore which provided most of the wintering; unless a means of access was retained enclosure would destroy the value of these farms as integrated holdings and necessitate considerable abatement. On other farms enclosure of part of the arable land and wintering would make abatement necessary, and in some cases the estimated value of the woodland on a farm was less than the probable cost of abatement if it were enclosed (Cregeen, ed. (1964) 126-34).

The estimated cost of enclosing selected parts with dry stone was about £472 sterling, with £55 for abatement (Cregeen, ed. (1964) 132-4). The real cost of abatement was higher than these sums indicate. Abatement was necessary in every year when the wood was enclosed; the capital

cost of stone enclosure was high but maintenance costs afterwards were low. Many proprietors employed the cheaper expedient of building temporary fences of coppice timber, designed to last no longer than was thought necessary. The exact relationship between the increments of a given area of woodland with and without enclosure could not be established; crude measures were therefore employed. The Morvern surveyors compared the gross estimated bark yield of woodland with the cost of abatement (Cregeen, ed. (1964) 126-32); they could not specify the proportion of this yield which would be lost if the woods were not protected.

The intangibility of the benefits of protection in relation to the measurable value of pasture appears to provide a major reason for the general tendency to neglect the enclosure of coppice or to open it for grazing earlier than external observers thought advisable. Thus in Ardnamurchan after the coming of southern sheep it was thought bad management to restrict wintering more than absolutely necessary for the sake of timber and bark; after 1850 Brown noted that in Scotland as a whole grazing animals were admitted too early, as grazing rents were considered greater than the increase of value of woodland under protection (NSAS (1845) V.7 (Argyll), 250, Brown (1861) 58).

The loss of wintering could destroy the viability of tenant holdings and therefore disrupt the operation

of the local society and economy; claims that enclosure would render holdings untenable were not uncommon. Thus the tenants of Craigrostan on Loch Lomond submitted a petition to the Montrose commissioners in 1758, stating that during eleven months of each year the only pasture available to them was within woods which were due to be enclosed; if this pasture was lost tenancy would become impossible (SRO GD.220 [Wb.4]). In 1780 the tenants of Camghouran on the estate of Struan claimed that their best pasture and their only wintering would be lost if the pine wood of Rannoch was enclosed. In their view the wood had always flourished without protection and they were completely dependent on livestock; their cattle could not survive without the wood pasture and they would be destitute without their cattle (SRO E.783/60/253, E.783/60/257(1)). These tenants had no formal leases but customarily grazed their cattle in the wood, and complete enclosure would also prevent access to their hill pasture and peat moss (SRO E.783/60/257(1), E.783/76/9); a solution was found to the problem of access to the hill, but the tenants' claim for abatement for the loss of wood pasture was disregarded (SRO E.783/60/300, E.783/76/11).

There is almost certainly an element of overstatement in these claims, and both cases were exceptional in relating to farms where woodland was a major part of summer pasture as well as wintering. The employment of the mechanisms of abatement in areas with less woodland pasture was nevertheless a recognition of the importance of

wintering and the necessity of reducing stocks when it was curtailed. The degree to which proprietors responded to the pleas of their tenants must have varied greatly but landowners with a sense of social responsibility, and the larger number whose tenant populations could not easily be reduced or given alternative employment, may have found in this an additional reason for giving low priority to the efficient management of woodland on their estates.

The conflict of interests could be reduced if protection was confined to the most valuable woodland; this generally consisted of the best preserved and most compact areas. Scrub could be reclaimed as coppice but no profit could be expected for a number of years; straggling woods were unattractive, as enclosure often required inclusion of land bearing little or no timber. The cost of enclosing a number of fragments of woodland was considerably higher than the cost of fencing a compact block equal to them in area; for this reason purchasers of coppice were encouraged to cut systematically through the wood (SRO E.721/4, 171). In 1771 it was found that there were two practicable ways of enclosing the wood of Tombea near Leny in Perthshire. If one was chosen the line of fence would exclude outlying oaks and birches; the other was likely to be more expensive and also entailed the enclosure of twenty acres (8.1 ha) of pasture, making abatement necessary (SRO E.777/136/1 (2)). In such cases the cheaper option was often taken and the boundaries of managed woodland were arranged to include only the main

body of wood.

In Morvern the enclosing walls were designed to exclude scattered trees and the open fringe of woodland (Cregeen, ed. (1964) 129-31). The first report on the enclosure of the pine wood of Rannoch recommended that attention should be concentrated on the compact block of the Black Wood, although the smaller areas of pinewood adjacent to it could be enclosed at a later date (SRO. E.783/76/9). Scrub woodland which had little value in itself but had potential value as coppice was often disregarded and areas of open ground with evidence of regeneration were also left unprotected. Thus the scrub of the upper margins of coppice was neglected even in north Dunbartonshire, where coppicing was of considerable importance (Whyte & Macfarlan (1811) 156-7).

The species composition of wood provided another basis for the selection of areas for management. Oak and ash were the species of greatest commercial value for timber and bark, and the other species known collectively as 'barren timber' were given little attention or neglected completely (below, 7.5). The enclosure scheme for Morvern excluded areas dominated by these subordinate species, and the only woodland in Menteith excluded from the regular rotation pattern of cutting and enclosure was described as consisting of birch with only a small amount of oak (SRO. GD.220 [Wm.16], Cregeen, ed. (1964) 129-31). The development of oak tanbark coppice

ensured that attention was given primarily to oakwood, and many areas of barren timber appear to have been exploited without protection.

The management of semi-natural woodland therefore required the selection of a compact nucleus consisting of healthy trees of the more valuable species for protection and conservation; much of the inferior timber was exploited but not brought under any form of regular management. As long as the management of woodland remained merely an appendix to the existing agricultural system it could not in itself be developed efficiently; any increase in the profit from the commercial sale of woodland produce was achieved at the expense of the income from grazing. The value of wood produce and knowledge of coppice management grew in the later part of the eighteenth century, but other land uses external to the traditional Highland economy also developed and created additional pressure on the land most suited to the conservation of woodland.

Management was affected by the relative value of pasture and woodland. The gradual expansion of managed coppice in the eighteenth century was an evident response to the increased value of woodland produce (below, 7.4); the rapid abandonment of large areas of coppice in Argyllshire after the establishment of extensive sheep-farming indicates a sudden change in the relative value of the two land uses (Monteath (1827) 54). The selection of

an area of timber for careful management at a given time was therefore influenced strongly by the requirements of pastoralism. It was unlikely that woodland initially rejected would later be added unless the value of woodland produce rose markedly; the quality of woodland excluded earlier from management was not likely to have improved, and the general pressure of grazing demand imposed approximate limits on the area within an estate which could be reserved as woodland.

There is little evidence of the deliberate clearing of areas of inferior timber for pasture; the presence of trees was an asset in providing shelter for grazing animals. Woodland tends to degenerate more or less slowly into scrub or open woodland if exposed to uncontrolled grazing and casual exploitation; there may be a final deterioration into low brushwood and cropped growth, especially in the case of deciduous species. No clear distinction between woodland and pasture is possible, but it is likely that at a certain stage a given area came to be regarded locally as pasture with wood or scrub rather than woodland with pasture. After such a point open woodland would remain unprotected as an adjunct to pasture and a source of timber for local use, although dense low scrub would be an obstacle to the full use of the grazing area. In the case of deciduous species intervention at almost any stage in the decline could restore some of the value of woodland, but the possibility of protection almost certainly grew

smaller as the process of deterioration advanced.

A large amount of woodland cover, especially that of the less valuable species, survived in varying stages of degeneration after the establishment of coppice management for commercial sale. According to a survey of 1769 the single holding of Finlarig on Loch Tay contained areas described as bad grass with alder and pine, thick pine wood with poor grass, and strong heath tending to pine; another farm on the same estate contained an area of grass with alder and hazel which the surveyor regarded as wood but which was locally considered as grassland (MacArthur, ed. (1936) 6,57). Lesslie's survey of the estate of Struan in 1756 indicated that one birch wood of more than 300 acres (122 ha) was of little value except as shelter, and the pasture of many farms contained scattered trees and brushwood of birch, alder and willow (SRO E.783/98 36, 40, 47-9). Later in the century Marshall observed that the wintering of north Perthshire as a whole would be improved by the removal of briar and brushwood (Marshall (1794) 63).

Management could be facilitated to some extent by modification of the grazing stock and removal of the more destructive grazing animals; as might be expected, the goat was the most common victim of this policy. There can be no doubt that some proprietors considered the presence of goats incompatible with the conservation of timber. As early as 1703 a tack of lands issued by Campbell of

Glenorchy required that no goats should be pastured in the woods (Innes, ed. (1855) 428); five years later it was proposed that proprietors in the regality of Atholl should be ordered to erect goat-proof fences round their woods (EUL Dc.I.37 1/3, 12). Other attempts were made to control the grazing of goats before 1750 with varied success. Murray of Stanhope tried to ban goats from farms in Ardnamurchan after 1723, but concessions and compromises were necessary and goats were still kept in defiance of the tacks twenty years later (Megaw (1963) 202-3). The Montrose commissioners realised the danger of damage by goats, but did not apparently take early action; damage was recorded near Aberfoyle about 1740 and as late as 1757 they were allowed free access to woodland of high quality on Loch Lomond and caused considerable damage (SRO GD.220 [Wm.18, Wb.3]).

Goats were regularly grazed on the hill pasture of Struan, but in 1771 the new grazing regulations prohibited pasturing of goats near woods and fences; when the pine-wood was enclosed it was recommended that the exclusion of goats should be ensured (SRO E.783/76/9, E.783/84/1, E.788/20/4). The enforcement of prohibition was still difficult at this time; in 1783 the duke of Argyll was forced to proceed against a tacksman who had not paid a substantial fine for keeping goats and compensation for damage to woods (Cregeen, ed. (1964) 120). The policy of proscription followed on the Breadalbane lands after 1703 was evidently effective, however, and goats formed a tiny proportion of the stock on Loch Tay by 1769 (MacArthur, ed.

(1936) lxiii, 6n). Ardnamurchan was free of goats by 1798, but in neighbouring areas where timber was of smaller commercial importance they accounted for more than five per cent of a stock dominated by introduced sheep (OSAS V.20 (1798) 294).

Sheep of the Highland breed were at times treated in the same way; they were banished from the low ground of Caputh parish in Perthshire to protect plantations, and prohibition was also recorded in Lethendy parish (OSAS V.9 (1793) 493, V.17 (1796) 532). By 1845 Leicesters were being grazed on the lowland of Moneydie parish, being thought less harmful to enclosures than the native breed (NSAS (1845) V.10 (Perth), 206). The discouragement of traditional sheep seems to have occurred only in districts where goats had already been prohibited. In the old economy both sheep and goats were a valuable source of milk but sheep also provided wool for local use; they were thought less harmful and were allowed less freedom in grazing. These advantages were said to explain the relative decline of the goat in Jura (OSAS V.12 (1794) 322).

Goats were also at times said to have declined in the two counties because of the development of extensive sheep farming (Robertson (1794) 69, Smith (1805) 282). This did not result from deliberate prohibition; there is no evidence of the banishment of goats with the intention of protecting the interests of sheep. In many areas where sheep farming was imposed on the existing economy,

however, the grazing land available to small tenants was greatly restricted; hill pasture was essential to sheep farming and the high quality of the pasture around shieling huts commended these sites in particular to sheepmasters (Gray (1957) 97-8). Greig attributed the feralisation of the goat population largely to the development of sheep farming and the consequent reallocation of shielings; goats were summered and wintered as far as possible on the upland and declined in the stocks of small tenants when upland pastures were appropriated for sheep. In some areas goats survived as a feralised population (Greig (1970) 8, 13); thus the goats of Ben Venue in Perthshire were thoroughly wild by 1819 but were still considered to be private property (Herford, ed. (1929) 35).

The decline of domesticated goats corresponded in broad terms to that of shielings; in the later part of the eighteenth century shielings were reduced in number in Perthshire, and as the nineteenth century advanced they were confined increasingly to the west and finally the islands (Whitaker (1959) 168-72). The expansion of sheep-farming affected the islands of Argyllshire and some parts of the western mainland relatively little before 1800, and the number of goats in these areas declined only when the sheep system was consolidated after that date (Gray (1957) 97). They survived longest as domestic stock in the western districts and most of the present feral population is concentrated in the same areas.

4.6 Extensive sheep farming in relation to woodland

A major force after 1750 was the imposition of a new grazing stock of southern sheep. The arrival of sheep did not result in major changes in attitudes to woodland, but tended to accentuate certain factors already established in the traditional economy; the influence of sheep during the relatively short term of their dominance was nevertheless important, and disproportionate to the time in which activity was intense. Southern sheep were introduced to the Highlands after the middle of the eighteenth century; the first flocks appeared in Dunbartonshire and south Argyllshire shortly before 1760 and soon afterwards in Perthshire (Watson (1932) 6-8, MacLagan (1958) 68). Extensive sheep-farming then advanced north and eastward rapidly; some flocks were established north of the Great Glen by 1790 and the movement continued after 1800, including most of the north by 1820 (Gray (1957) 88, MacLagan (1958) 8).

The process was far from uniform; certain districts including the Argyllshire islands and the coastland of mid Argyll remained largely free of sheep until the pattern was consolidated in the early nineteenth century (OSAS V.7 (1793) 441-2, Gray (1957) 97). The policies of individual proprietors were in part responsible; thus the fifth duke of Argyll allowed sheep-farming in Morvern but was said in 1794 to have limited the spread of sheep in Campbeltown parish (OSAS V.10 (1794) 562,

Cregeen (1970) 12-13).

The fundamental problem of sheep-farming in the Highlands was that it became established on an extensive scale in a society and economy ill-equipped for radical change; small tenants were not able to participate to any extent and their traditional pastoral requirements conflicted with those of sheep. Eviction and displacement were common in the north, where sheep rapidly became dominant and were generally kept in large numbers (Gray (1957) 93, 96). In Perthshire and Argyllshire the scale of sheep-farming was rather smaller and mass clearance less frequent, although displacement by amalgamation of farms was recorded before 1800 (OSAS V.3 (1792) 467, V.4 (1792) 574). If small tenants survived it was inevitable that the stocks held by them should be reduced; thus some tenants were displaced from farms on the Argyll lands in Morvern but the sub-tenants of tacksmen generally remained on their holdings, grazing stocks considerably smaller than previously with little upland pasture (Gaskell (1968) 17). Large areas in both counties were affected by a new grazing regime, and the traditional wintering grounds were under increased pressure through much of the year from sheep and the stock of small tenants.

The main element in Highland sheep husbandry was the wedder stock, pastured on the upland in summer and wintered at lower levels; the breeding stock of ewes was generally much smaller and occupied the pastures formerly used by

milk cattle (Watson (1932) 9, MacLagan (1958) 69). Wintering capacity still limited the size of stocks and summer pasture remained under-utilised. This is still the case, although the replacement of cattle by a larger number of head of sheep and the quotation of the impressive totals grazed on large amalgamated farms has given a misleading impression of greater stocking density after the arrival of sheep (above, 4.2). The traditional reservation of low pasture during the summer was no longer possible in some cases; valley land and the lower parts of the hill pasture were pressed into service in summer to accommodate the ewe stock and tenant stocks.

There were considerable direct effects on existing woodland. In a number of districts upland grazing and its woodland was pastured almost entirely by sheep; at the same time, wintering remained of great value. Established areas of well-managed coppice and other woodland were retained, but casually managed timber and scrub which had potential value was returned to pasture. Although it had been under sheep for more than thirty years the parish of Lochgoilhead in Argyllshire still contained profitable and well-managed coppice and plantation after 1790 (OSAS V.3 (1792) 170, 177-8). Some years later, however, Monteath selected Argyllshire as a whole as the most notable example of a Highland tendency to allow the leasing of extensive areas of scattered woodland as pasture (Monteath (1827) 53). Sixty years after the introduction of sheep

to Morvern oak and ash coppice was still carefully preserved, but almost every other form of wood was in decline (NSAS (1845) V.7 (Argyll), 176). The coming of sheep therefore tended to limit farther the area of woodland protected from pastoral use.

There is some evidence that woodland was cleared during the expansion of sheep-farming. In 1807 it was said that the woodland of the Highlands was gradually disappearing to make room for sheep, despite the value of shelter in the lambing season (Singers (1807) 552-3); in Morvern it was said in 1845 that '... for the benefit of the much-indulged sheep, the wood-axe is aimed at almost every other description of timber' (except oak and ash) (NSAS (1845) V.7 (Argyll), 175). It does not seem credible that sheep-masters should deliberately have attempted to clear the limited area of shelter on their farms; a certain amount of low scrub may have been removed, but it is probable that the destruction of woodland was more often incidental to actions intended to be of direct value in sheep-farming. Thus in the Morvern case timber may have been cut to provide fencewood, rather than as a means of clearing grazing land.

One of the most significant aspects of sheep management was muirburn, which had an incidental but pronounced effect on the quality and quantity of woodland. Muirburn was established relatively early in Scotland; it was prohibited after March as early as 1400, and between March

and the end of harvest by a statute of 1424. In 1478 the penalty was increased, as burning was being done in all months (APS V.1 (1844) 576b, V.2 (1814) 6, 119). The original purpose was evidently not the improvement of pasture; if this had been the intention it might be expected that the burning of extensive areas would have occurred as a communal activity like other aspects of Highland pastoralism. Available evidence indicates piecemeal casual burning, however, often carried out by individuals.

The Glen Orchy court regulations of c.1620 make it clear that firing was done by individual tenants, although each burner was required to have the assistance of six neighbours (Innes, ed. (1855) 366). Muirburn could also take place at low levels; the statute of 1424 was apparently designed to protect the growing crop, and in Glen Orchy it was stipulated that burning should take place only on the 'mount' or hill pasture (Innes, ed. (1855) 352). A connection was frequently made between muirburn and damage to woodland, which would be less likely if burning was initiated on isolated areas of high pasture. Some statutes included it among offences against woodland and baron courts attempted to restrict the practice to protect growing woods (APS V.2 (1814) 343).

The Glen Orchy regulations prescribed that muirburn was not to take place where there was '... aney wod or danger of wod ...' (Innes, ed. (1855) 366). Some indication of the true purposes of muirburn is provided by reg-

ulations relating to Strath Carron in Easter Ross in 1661, which prohibited muirburn within a quarter mile (0.4 km) of young wood and allowed each man to burn no more than was necessary for a year's fuel (MacGill (1909-11) V.2, 50). Such evidence supports Fenton's suggestion that in the traditional economy muirburn was often, perhaps in the majority of cases, a means of clearing a surface for the stripping of turf; turf was used as a fuel, and also as fertiliser, roofing and dyke material (Fenton (1970) 167-70). In the form applied by later sheepfarmers, however, it was primarily a method of replacing old and inedible heather; the Glen Orchy restriction of burning to grass alone suggests preservation of heather for grazing, fuel, thatch and bedding (Innes, ed. (1855) 352).

Muirburn seems to have declined to some extent in the eighteenth century (Fenton (1970) 156-62. Thus on the estate of Urie the supply of fuel was strictly controlled by the baron court and muirburn was totally banned in 1724 (Barron, ed. (1892) 125). When extensive sheepfarming brought systematic muirburn to the Highlands for the improvement of pasture it was recognised as a new practice. Writing of Argyllshire, one enthusiastic proponent of muirburn claimed that it was an ancient Highland method of improving pasture, but his own evidence indicates that some proprietors were not willing to allow it, and that the impetus came from observation of the established

sheep economy of the Borders (Smith (1799) 231-40).

Burning was at times deliberately aimed at the clearance of thorn scrub in which sheep could be entangled, and in other cases scattered trees on upland pasture were burned in the course of rotational firing (Smith (1799) 237-8). At other times, however, the burning of timber appears to have resulted from failure to control the process. A cautionary editorial footnote to Smith's essay recorded personal observation of several cases where uncontrolled muirburn had damaged deciduous and coniferous woodland, in some cases remote from the origin of the fire (Smith (1799) 249n). Fire damage to mature timber is not necessarily fatal; deciduous trees burn with difficulty and the remains will recover rapidly if coppiced (Edlin (1956) 85-6, Wormell (1970) 96). In the case of pine, however, mature trees cannot produce coppice shoots and young growth cannot survive repeated burnings, which may inhibit regeneration more effectively than grazing (McVean & Lockie (1969) 40, below, 5.3).

This type of muirburn is symptomatic of a more permanent form of deterioration of pasture and woodland under grazing. Under unregulated grazing by mixed stocks upland soils are degraded by leaching and locally by erosion (Edlin (1956) 80-1). Sheep are notoriously selective grazers and thus intensify the process of degradation; by concentrating on a few favoured species they impoverish the range of vegetation and encourage

invasion by plants unpalatable to them, which tend to be those which emphasise the acidity of the soil. In the traditional economy the more superficial and less selective grazing habits of cattle, although part of the general pattern of degeneration, almost certainly reduced the rate of decline (Ryder (1968) 155, McVean & Lockie (1969) 40).

Muirburn is immediately effective as a means of rejuvenating upland pasture, but in the long term it accelerates the degeneration of soil and vegetation; repeated disturbances of an unstable vegetation make more possible the invasion of coarse sedges and grasses, bracken, and other unpalatable plants (McVean (1959) 79-80). In the dry conditions of central and eastern Perthshire muirburn may perpetuate heather moor, but in the wetter west continued burning allows grass heather to achieve dominance (McVean & Lockie (1969) 38). In both cases conditions become less favourable for tree regeneration outside woodland within a relatively short time; within existing woodland regeneration will decline under continued grazing and the occasional effects of poorly-controlled fire, unless some form of protection is available.

The harmful effects of a monoculture of sheep were not generally recognised for some time; critics concentrated their attention on the deleterious social consequences of sheep husbandry. In Argyllshire the relatively rapid conversion of heather moor to a cover of grasses and sedges was welcomed as the 'greening' of the hills

(OSAS V.5 (1793) 465, V.8 (1793) 338). Even Monteath, whose intense interest in coppice might have led him to denounce a form of land use opposed to his own aims, praised the introduction of sheep for enriching the country and utilising waste land (Monteath (1827) 111-14). Muirburn and other specific aspects of sheep husbandry were criticised, but little was said about the effects of sheep on the land (Smith (1799) 249n).

In 1807 Singers favoured sheep-farming but considered that the most effective method had not been found; he thought it inevitable that the movement would go to extremes in the initial phase and that the grazing of sheep alone was not feasible in the long term (Singers (1807) 536-8). Not until about 1850, however, was the deterioration of grazing land and the decline of stocking capacity generally noticed. Only then did sheep begin to lose their place in the modified Highland economy; prices for wool and mutton declined and the development of grouse breeding and deer forest provided competition for upland pasture (Watson (1932) 14-16).

While sheep remained dominant a much greater proportion of the grazing stock than previously consisted of animals relatively harmful to timber and regeneration. Overall stocking densities increased less than is sometimes believed, but the pre-existing regime of seasonal use of pasture was disrupted; both wintering ground and upland pasture were subject to sustained pressure where wedder

and breeding stocks were maintained, especially if a dense population of small tenants retained some animals within a constricted area. There was a general reduction in the extent of woodland under strict control at low levels. In association with the grazing of a single species with selective eating habits muirburn hastened the deterioration of upland pasture and made more difficult the regeneration of woodland in that environment.

4.7 Other competing land uses

It might be expected that records would exist of the removal of woodland cover at low altitudes to increase the limited arable area, but there is very little direct evidence. Early examples of the process can be traced relating to other parts of Scotland but few relate specifically to Perthshire or Argyllshire (Neilson (1910) 360). In 1621 a tenant in Glen Orchy admitted to the baron court that he had uprooted hazel and willow for tillage (Innes, ed. (1855) 372); these species were common as scrub on low pasture, however, and the object of clearance may have been the conversion of pasture to cultivation. A tack of land in Clunie parish in Perthshire in 1677 allowed the cutting of alder timber within the balks of the corn land (SRO GD.16/28/133); scrub evidently grew in the poorly-drained hollows between the rigs.

The encroachment of tillage on woodland is generally a gradual process, and the type of evidence available for

the Highlands before 1700 may be inadequate to trace such a movement, but it is also possible that by the seventeenth century extension of the arable area could be achieved by the more regular use of existing outfield and the conversion of pasture land in small amounts. There is little evidence of the direct prohibition of clearance for tillage in national legislation or local court regulations, but there is evidence of the tillage of open spaces within woodland, a process which would inhibit regeneration to some extent without serious physical damage to existing trees.

Controlled tillage was allowed in the wood of Kincardine after 1650, and purchasers of the wood were permitted to till certain areas within the wood dyke as late as 1736 (below, 9.2). In the 1750s the arable land of Craigrostan on Loch Lomond consisted of fragments among the wood temporarily enclosed in summer (SRO GD.220 [Wb.4]); the management of Lorn Furnace complained in 1798 that the tenants of lands on Loch Sween in Knapdale were ploughing over roads, charcoal hearths, and other areas within the woods purchased by the company (NLS MS.993, 56). Travelling in Knapdale soon afterwards, Leyden found that plough or spade cultivation was employed even on the least accessible patches of arable land (Sinton, ed. (1903) 64). Such a practice is not likely to have been recorded frequently unless expressly forbidden, and it may therefore have been more common than is suggested by existing evidence.

More definite evidence of the clearance of woodland appears after 1770, in association with the introduction of agricultural improvements to both counties and especially southern Perthshire. In some cases brushwood, whin, and broom were eradicated, as in Strathallan after 1770 and Knapdale after 1800 (OSAS V.12 (1794) 48, NSAS (1845) V.7 (Argyll), 276). Semi-natural woodland was grubbed up in a number of districts. In the parish of Clunie in southeast Perthshire coppice was neglected by 1793 and some parts had been taken for tillage (OSAS V.9 (1793) 241n); in 1845 it was reported that experiments in the conversion of woodland through pasture to tillage were being conducted in Logierait parish in the Tay valley (NSAS (1845) V.10 (Perth), 695). Coppice was much more secure in other areas; it was said that in the western part of Scotland coppice was too valuable to be cleared, especially as it generally occupied sites of marginal economic value (Graham (1812) 213).

This partial clearance of existing areas of woodland may be explained mainly by improvement in the value of agricultural land and the fashion for estate improvement. A certain proportion of the woodland of Argyllshire and Perthshire was on sites which had some agricultural value, but as already noted agricultural improvement within the Highland areas was limited (above, 2.5). In southern Perthshire interest in the extension of cultivation was strong enough to lead to the clearance of immature plantations. Before 1800 young planted wood was being

cleared from the Carse of Gowrie and by 1820 a considerable area in Gowrie and Strathmore had been cleared; the enthusiasm which had previously led to the planting of trees on relatively good land was now diverted towards the improvement of agriculture (OSAS V.4 (1792) 485, Donaldson (1794) 30, Anon. (1819) 19).

A certain amount of semi-natural woodland was cleared to make way for plantations in the same period; the sites of existing woods and areas which bore evidence of previous forest cover were with some reason assumed to be suitable sites for planting. Most Highland plantation was on the intermediate slopes which were the habitat of the surviving semi-natural woodland, and relatively large areas of scrub and poor woodland must have been cleared or suppressed by growing plantation. Thus in Clunie parish extensive coniferous plantations had by 1845 replaced heath, broom, and brushwood (NSAS (1845) V.10 (Perth), 1024). The extension of plantation did not invariably result in the removal of semi-natural woodland of high quality; certain forms of plantation were designed to increase the effectiveness of coppice, and there are in fact records of the planting of oak for use as 'natural' or coppiced woodland (below, 7.6).

4.8 The effects of grazing and other land uses

Almost all of the woodland of the two counties was under grazing pressure throughout the period; this was

part of a process which was already established in the seventeenth century and continued in a modified form after 1850. As already noted, grazing was in many cases accompanied by exploitation of woodland for local consumption (above, 3.8). It is remarkable in the circumstances that so much woodland has in fact survived, especially if activity in the period after 1650 represents a late stage in a process which has continued throughout the period of human colonisation. It is evident that the decline of woodland under pressure from agricultural communities may be a very slow process.

The survival of semi-natural woodland under such conditions may be accounted for to some extent by the relatively slow rate of deterioration shown even under intense grazing pressure. The deciduous species of the Highlands have two mechanisms of regeneration, in the form of seeding and coppice regeneration. Their resilience under continued grazing pressure was frequently noted in the eighteenth and nineteenth centuries; Smith observed that in Argyllshire persistent grazing had led to the formation of large areas of brushwood and stunted oak (Smith (1805) 154-5). It was commonly believed that such scrub would be of some value if protected from grazing animals for some time; Monteath noted that even after a period of grazing by lowland sheep former oak coppice in Argyllshire still produced strong coppice shoots which would be useful if enclosed (OSAS V.8 (1793)

45-6, Monteath (1827) 54).

Coppice regeneration is not in itself of long-term value as a means of survival, but it allows individual trees to survive periods of intense grazing pressure; a reduction in the severity of grazing for a few years may be sufficient to allow sections of scrub to develop into poor woodland relatively secure against farther damage by grazing, and reduced grazing intensity may also permit some regeneration from seed. In Perthshire and Argyllshire such conditions may have favoured the survival of birch rather than oak. The relative decline of oak has already been noted (above, 2.4); in the Highlands the tree is near the margin of its European distribution and regeneration is poor. Even in the more favourable edaphic and climatic conditions of southern England the production of a good seed crop, which requires a warm late summer and autumn, occurs irregularly and at long intervals; such crops may be produced only once in every six or seven years and in many years the seed crop fails almost completely (Jones (1959) 173, 193-4).

Regeneration of oak scrub or poor woodland under grazing pressure in Highland areas therefore depends largely on the coincidence of favourable conditions for seed production and some relaxation of the intensity of grazing. It is probable that the oak woodland of the two counties survived mainly by coppice regeneration when protection was not available, and this would not permit

colonisation of new ground; the slow growth of oak in the region in present climatic conditions makes even coppice regeneration of oak difficult without protection of some kind (McVean & Lockie (1969) 55). Birch and alder, however, are more resistant to damage by fire and grazing and also more prolific in seeding. Birch is adapted to the rapid invasion of open ground to the extent that, for reasons which are not entirely clear, regeneration is not common under the cover of mature birches; the behaviour of alder is comparable, although it generally thrives in moist conditions (McVean & Ratcliffe (1962) 19-20, 23-4, McVean & Lockie (1969) 55).

It is evident that other deciduous species apart from oak are less resistant to grazing damage than birch and alder; rowan and holly regenerate poorly in woodland grazed by sheep. McVean found that rowan was able to regenerate on islands accessible to deer in west Highland lochs but not in woodland readily accessible to sheep on the adjacent loch shores (McVean (1958) 202-7). Holly tends to form a persistent but poor scrub when heavily grazed. The species appears to have declined relatively rapidly in quantity and quality in the British Isles in the recent past; woods of large hollies were described in northeast Scotland in the early nineteenth century but only fragments now survive in the Highlands and the shrub form which is now characteristic appears to have been created largely by grazing (McVean (1958)

202, McVean & Ratcliffe (1962) 23, Peterken & Lloyd (1967) 849, 855).

Scots pine does not produce coppice shoots and must therefore propagate by seed regeneration; grazing damage has undoubtedly been an important agent in the history of the species but assessment is complicated by the form of regeneration which seems characteristic (Steven & Carlisle (1959) 83-5). Extensive and rapid regeneration appears to depend on the coincidence of a good seed year with the availability of open ground fortuitously prepared for colonisation by fire (McVean (1961) 299). Like other Highland tree species, however, pine is not equipped to regenerate successfully in the conditions resulting from repeated and systematic muirburn (McVean & Lockie (1969) 40).

It has already been noted that birch acts as a pioneer species in Highland conditions (above, 2.4). Regular grazing by domesticated animals appears to inhibit climax formation and gives undue prominence to the pioneer species (McVean & Ratcliffe (1962) 19). It may therefore be expected that in Perthshire and Argyllshire continued grazing, associated with casual cutting of timber for local use, would create a pattern of poor woodland containing a limited number of tree species dominated by birch, with alder occupying the moister sites. The present pattern is not dissimilar to this, although woods dominated by oak survive in both counties (McVean

(1964a) 155-6).

Chard attributed the poverty of present birchwood largely to the use of the grass stratum or ground layer of the wood as sheep pasture (Chard (1953) 126). Edlin viewed the evolution of these woods in a longer perspective, considering that much of the oak and birch scrub of the Highlands as a whole is a form of vegetation which cannot be regarded as the climax type, having been degraded in use as coppice by neglect, exhaustion, and exposure to grazing; he believed that coppice was the worst crop to be grown in areas subject to unrestricted grazing and casual cutting (Edlin (1955) 145, Edlin (1956) 104-5). The existence of extensive areas of scrub has however been observed in circumstances where commercial coppicing cannot be taken as an explanation. Damage by grazing is the factor most generally associated with the development of scrub; casual exploitation of woodland produce may have contributed to the decline, but recovery beyond the stage of scrub would generally have been possible in the absence of grazing animals.

It has been observed that during the period goats were considered to be the most harmful of the domesticated grazing animals, and that this led to their removal from stocks in both counties (above, 4.4, 4.5). Unfortunately the damage caused by grazing of any kind is seldom of a type which can adequately be detected and recorded in documentary form. This may explain why little evidence is

at present available to indicate that goats did in fact cause widespread damage, or that the persistence of the goat in Argyllshire and particularly the islands after the general disappearance of the species from Perthshire had a significant effect on the woods of the west; goat populations in the later part of the period may have been too small to have a measurable effect. More evidence relating to the size and distribution of goat populations in the two counties is necessary.

4.9 Summary

The grazing regime of Argyllshire and Perthshire was highly seasonal; upland summer pastures were generally understocked but much of the woodland was on the low-lying pastures vital for the survival of the grazing stock in winter. Cattle were commercially important and goats were numerically significant until the end of the eighteenth century; they were recognised as inimical to woodland and banned from many estates.

Management of woodland for commercial use made enclosure of woodland and protection against grazing necessary, but the demand for grazing land limited the extent and effectiveness of management severely. The introduction of extensive sheep-farming after 1750 led generally to increased pressure on winter grazing and reduction of the area of managed woodland. Sheep were more harmful to woodland than the traditional stock as a whole and

deterioration of pasture under sheep led to the regular burning of upland pasture, a practice which inhibited colonisation of open ground by tree species. There is little evidence of the clearing of semi-natural woodland for pasture or cultivation but plantation replaced or augmented some areas of poor woodland.

Grazing has apparently been one of the most significant single factors affecting woodland in Perthshire and Argyllshire; there appears to have been a tendency under grazing towards increased dominance of birch in woodland impoverished in species and quality.

CHAPTER FIVE

THE HISTORY AND COMMERCIAL USE OF PINEWOOD

5.1 Introduction

As early as the beginning of the eighteenth century accounts of the Highlands recorded the existence of large numbers of stumps of pine and oak embedded in peat, not infrequently on sites devoid of living wood (Martin (1703) 142, Mackenzie (1710-12) 299). Observers drew from this evidence the reasonable inference that a dense cover of woodland had formerly covered most of the region, and some identified it as the Silva Caledonia (Newte (1791) 118, Campbell (1802) V.1, 96-7, 233-4, Hall (1807) V.2, 411). As living woodland was often absent from the areas in which bog timber was most conspicuous travellers accepted that there had been a considerable reduction in tree cover, but there was some difference of opinion about the date at which this had taken place. Some believed that areas of this type had been bare of woodland for a long time; Burt attributed the hardness of bog timber to immersion in peat for many ages, and Dorothy Wordsworth regarded the timber on the Black Mount and Rannoch Moor as the debris of a long-decayed forest (Burt (1754) V.2, 281, Shairp, ed. (1874) 182). In some areas stumps remained in situ on or near the surface of the peat and they were sometimes

associated with living or moribund trees; some observers therefore believed that these were the last survivors of a gradual decline (MacCulloch (1824) V.2, 152-3, 179-80).

Others were more prepared to believe that the stumps were the remnants of forests which had been cleared rapidly in the recent past. Pennant enumerated the pine woods of the Highlands and stated that they were the survivors of extensive forests which had covered the region less than fifty years before his visit, but he did not describe the cause of their disappearance (Pennant (1771) 183). Lettice identified the stumps on Rannoch Moor as the remains of woods cleared during the making of military roads earlier in the eighteenth century, and in 1800 Leyden described the debris in Glen Tarbert in Ardgour as the last indications of wood which had covered the surrounding hills within living memory (Lettice (1794) 296, Sinton, ed. (1903) 145).

Commercial felling was in progress in some parts of the Highlands while most of these travellers were within the region, but it was not identified by them as an important factor in the disappearance of pinewood. More recently, however, it has been claimed that timber merchants destroyed huge forests of pine in a brief but intensive period of exploitation in the eighteenth and early nineteenth centuries (above, 1.4). Such a statement requires examination. The pinewoods of Perthshire and Argyllshire are relatively small and on the margin of the

distribution of the species in the Highlands; examination in isolation is not therefore desirable, and examination of these woods must be preceded by a brief survey of the history, ecology, and commercial treatment of pinewoods in the Highlands as a whole.

5.2 The history of Scots pine in the Highlands

Pollen analysis indicates that Scots pine reached its maximal extent in the British Isles late in the Boreal period, between 6500 and 5500 B.C; at the end of this period pine diminished rapidly in importance and the species has not since grown commonly in any part of the British Isles except Scotland (Carlisle & Brown (1968) 298, Pennington (1969) 44-5, 50). Evidence from Scottish sites indicates that the post-Boreal importance of pine varied throughout the country. In Scotland as a whole pine may have been most extensive about 7000 B.C: there was a general decline at the beginning of the Atlantic period immediately after the Boreal, and a limited resurgence in the succeeding sub-Boreal period, which continued until about 500 B.C. (McVean (1964b) 563-4).

There was considerable regional variation. In the Galloway Hills in southwest Scotland pine arrived late and was probably confined to the poorer upland sites, declining to negligible proportions about 5000 B.C. (Birks (1972a) 206). In northern Scotland pine generally survived better on upland and inland sites after the

Boreal period; in the far northeast pine reached a maximum during the Boreal and declined slowly afterwards on lowland sites, remaining relatively important in the uplands (Durno (1958) 131-4). Upland sites have also yielded consistently higher proportions of pine pollen than lowland sites in eastern Aberdeenshire (Durno (1957) 180).

Durno interpreted available Scottish pollen diagrams as indicating that birch and alder were the principal post-Boreal dominant species, but found that in some parts of the Highlands pine remained abnormally important after the Boreal; this was the case in the northern part of the east Grampians, but not in the southern section (Durno (1959) 108-9). Pine appears to have arrived and expanded in Abernethy Forest in the Cairngorms about 5000 B.C., remaining significant through the following periods (Birks (1970) 840-3). A tentative zonation by Durno and McVean of sites at the head of Loch Maree in Wester Ross indicated that pine was codominant with birch in the Boreal, declining in the Atlantic and remaining subsidiary despite an increase in the sub-Atlantic (Durno & McVean (1959) 231-3); a more recent investigation in the same district suggests that pine rapidly became dominant after 6300 B.C., declining to some extent after 5000 B.C. and very rapidly in a short period after 2250 B.C. (Birks (1972b) 746).

Post-Boreal decline in the status of pine is very

likely to have been associated with climatic changes; pine tolerates a wide climatic range but flourishes in continental climates and it is near the western margin of the European distribution in Scotland. The purest stands are at present found in the east central Highlands, where the climate is more continental in character than in other parts of Scotland (O'Dell & Walton (1962) 37-42, Carlisle & Brown (1968) 277). As already noted, the present absence of the species from the oceanic conditions of the extreme west and southwest Highlands probably has a climatic basis (above, 2.4). Donner found that pine was dominant before the Boreal on several sites in the southwest Highlands; the species reached a maximum in the Boreal but was thereafter of little significance (Donner (1957) 255-7).

During periods such as the Boreal and parts of the sub-Boreal, when the continentality of climate increased, pine was able to flourish on a large number of Highland sites; when oceanic conditions became dominant the range of suitable environments became much more restricted. In such conditions the species appears to be sensitive to small climatic changes; Birks suggested that pine disappeared from the Galloway Hills when the climate became more oceanic, and thought it probable that the reduced incidence of good seed years, increased windthrow, and greater precipitation associated with increased oceanicity had led to the rapid decline of pine at Loch Maree (Birks (1972a)

206, Birks (1972b) 746). There was little change during this period in the status of pine at Abernethy in the east central Highlands, where climate was apparently less important than other environmental factors in affecting vegetational patterns (Birks (1970) 844); the climate of the region was presumably less sensitive to changes in the intensity of cyclonic activity than that of the west coast.

The role of early human settlement in the Highlands has already been considered in relation to woodland as a whole (above, 1.3); the direct role of man in the decline of pinewood remains to be established. It has been noted that at the beginning of the historic period colonisation was confined largely to the coasts and the major river valleys (above, 1.3); man was therefore probably not active in the areas climatically most suited to the survival of the species, but was in a position to clear pinewood from sites on the margins of the range. Reviewing the evidence relating to the decline of pinewood around Loch Maree, Birks considered the possibility that pine was climatically marginal enough there to be destroyed rapidly by populations of the type known to have colonised parts of the west coast by the time of the major decline, but concluded that environmental factors were chiefly responsible (Birks (1972b) 747-8).

It is known that small populations can have serious effects on woodland cover, but there is still little

evidence relating to the Highlands (Pennington (1969) 66-70, 74). The interpretation of existing palynological evidence is also difficult; heavy seed production by trees such as birch and pine may conceal the initial effects of colonisation, and accelerated change after the establishment of man may hamper interpretation of the pollen sequence (Birks (1970) 843). The importance of anthropogenic factors cannot be assessed until more is known about the scale and nature of colonisation and land use; present evidence suggests that the post-Boreal decline of pine in the Highlands was largely the result of climatic change.

It has already been observed that the strata of timber found in peat are probably prehistoric in origin, and pine is prominent among such debris (above, 1.3). It is possible that pine was little more extensive at the beginning of the historic period than at present. There is evidence that in some areas at least the present proportion of woodland was established before extensive commercial felling could have taken place; Durno and McVean considered that the extent of woodland in the Beinn Eighe nature reserve, which contains one of the surviving pinewoods, has remained approximately constant since the fifteenth century (Durno & McVean (1959) 236). It is also possible that the distribution of pine was comparable relatively early to the present limited pattern. Abernethy Forest contains one of the few rem-

aining major natural pinewoods of the Highlands. At Abernethy Birks identified one pollen assemblage zone, containing a high proportion of pine, as that preceding the arrival of man; this zone has counterparts only within the areas still occupied by native pinewood in Scotland (Birks (1970) 835-6).

There is considerable variation among early accounts of Highland woodland, perhaps because of the fragmentary nature of pinewood and the inaccessibility of much of it. The most favourable accounts were those which by their nature are among the least reliable in this context. Accounts of Scotland in descriptions of the nature and circumstances of the British Isles tended to be perfunctory and dependent on material of considerable antiquity and doubtful authenticity (Childrey (1661) 175-83). After Union Scotland was more fully described in such accounts, but authors continued when dealing with Scottish affairs to combine a limited amount of personal observation with hearsay and borrowings from other printed sources (Chamberlayne (1708) i-iv). Reports were influenced by erroneous ideas of the former extent of the Silva Caledonia, and their stylised descriptions of the great value and dimensions of Highland woods cannot be accepted as reliable evidence (Chamberlayne (1708) 415, Meige (1711) 24). Defoe's description of Scotland was probably based largely on his visits to Edinburgh and the south between

1706 and 1712 (DNB. V.14 (1888) 284-7); his account of the pinewoods twenty miles (32 km) long and proportionately broad in Ross-shire and other parts of the north Highlands was by his own account not based on personal observation (Defoe (1724-7) V.3, 208-9).

Even in cases where accounts were based on some personal experience, generalisation about Highland resources led at times to similar overstatement. John Spreull, a Glasgow merchant familiar with the timber trade, reported that large pinewoods existed in the north and west, having seen pine timber awaiting export at Fort William (Spreull (1705) 2-4, Burns, ed. (1882) 64). Accounts based on more intimate knowledge, especially those describing individual regions in some detail, present a rather different view of Highland pine. Macfarlane's Geographical Collections contain two detailed accounts of the regions of the Highlands, too similar to be unrelated; attribution of one of them to James Gordon of Rothiemay suggests that they refer to a period no later than 1655 (Mitchell, ed. (1906-8) V.2, 144-92, 509-613). It is quite clear from these reports that large pinewoods did exist, but that they were already isolated from each other and rare enough to merit mention individually by name. In 1677 Thomas Kirk, who believed that the Highlands were unsafe for those without armed guards, was nevertheless sufficiently interested to make an arduous journey of some sixteen miles (26 km) inland from Dornoch

specifically to view a pinewood in the vicinity of the present Amat Forest (Brown, ed. (1892) 29, 35).

Edward Burt worked and travelled in Inverness-shire and Argyllshire in the 1720s and found pine rare in his travels, although he knew of the timber operations of the York Buildings Company and was prepared to believe that pinewoods existed beyond sight of the main routes (Burt (1754) V.2, 6-7, 22). Forty years later Pennant assembled lists of surviving pinewoods seen by him or described to him during his Highland tours; ambiguity of description prevents precise identification of one of the eighteen examples, but fifteen correspond to modern native woods. Only two of Pennant's pinewoods have no present counterparts; one on Loch Leven then consisted only of a few trees, and there is little evidence but Pennant's to suggest that pine grew on the other site, in Sutherland (Pennant (1771) 183, Pennant (1774) 343, Steven & Carlisle (1959) 207, 213).

Although the difficulties of assessment which faced contemporary observers also prevent exact assessment in retrospect, documentary evidence appears to confirm that pinewood was uncommon and localised by the seventeenth century; Pennant's list serves to indicate that by the later part of the following century the location of pinewoods was substantially that of the present. This was probably largely true of the seventeenth century;

regional descriptions of the type mentioned above and the body of evidence assembled by Steven and Carlisle indicate that pinewoods were confined then to the territorial sub-regions which they now occupy (Steven & Carlisle (1959) 92-227). There is a limited amount of evidence of the disappearance of pinewood since the beginning of the seventeenth century, including a contemporary report of the disappearance of a small and moribund fragment near Ullapool in Wester Ross between 1650 and 1675 (Mackenzie (1710-12) 299-300).

Many surviving pinewoods are small, scattered and poor in quality, and it is not improbable that much of the deterioration can be attributed to factors operating in the period since 1650; although no large and healthy pinewood has disappeared completely a number of woods which are known to have been exploited exist now only as fragments. Even if those sub-regions known to have contained pine in the seventeenth century have all since suffered severe depletion of resources, however, the total area of these sub-regions is a very small part of the Highlands as a whole; change in the proportion of the Highland area under pine cover is therefore likely to have been insignificant. At present approximately 23,000 acres (9,315 ha) is under native pinewood; this may be compared with the possession by the Forestry Commission alone of 940,000 acres (380,700 ha) of land in Scotland under plantation or scheduled for plantation (Edlin (1969)

85, Goodlet (1973) 42).

5.3 Aspects of the ecology of Scots pine in the Highlands

As already noted, the species is restricted in distribution; this is indicated by Figure 5.1. Relict pines and pinewood are found on the mainland between 56° and 58° North (Steven & Carlisle (1959) 5); within this zone native pinewood is confined almost entirely to a limited number of known locations (Fig.5.1). Pine is a gregarious species and seed generally travels less than 100 metres (327 feet) from the parent tree (McVean (1963a) 672, Carlisle & Brown (1968) 282); healthy single trees or small groups isolated from pinewood communities are therefore uncommon. Not only is native pine relatively rare and localised, but there is evidence that natural regeneration is no longer regular. Analysis of the age structure of Scottish pinewoods showed in 1959 that trees aged between 140 and 190 years predominated; those between 100 and 140 years were generally present in smaller numbers but individuals of younger age classes were localised in distribution (Steven & Carlisle (1959) 76).

It is therefore evident that the component trees of surviving pinewoods originated largely between 1770 and 1820, and that there has been little effective regeneration since 1860; there is also documentary evidence that natural and assisted regeneration was successful in the late eighteenth and early nineteenth centuries (Steven

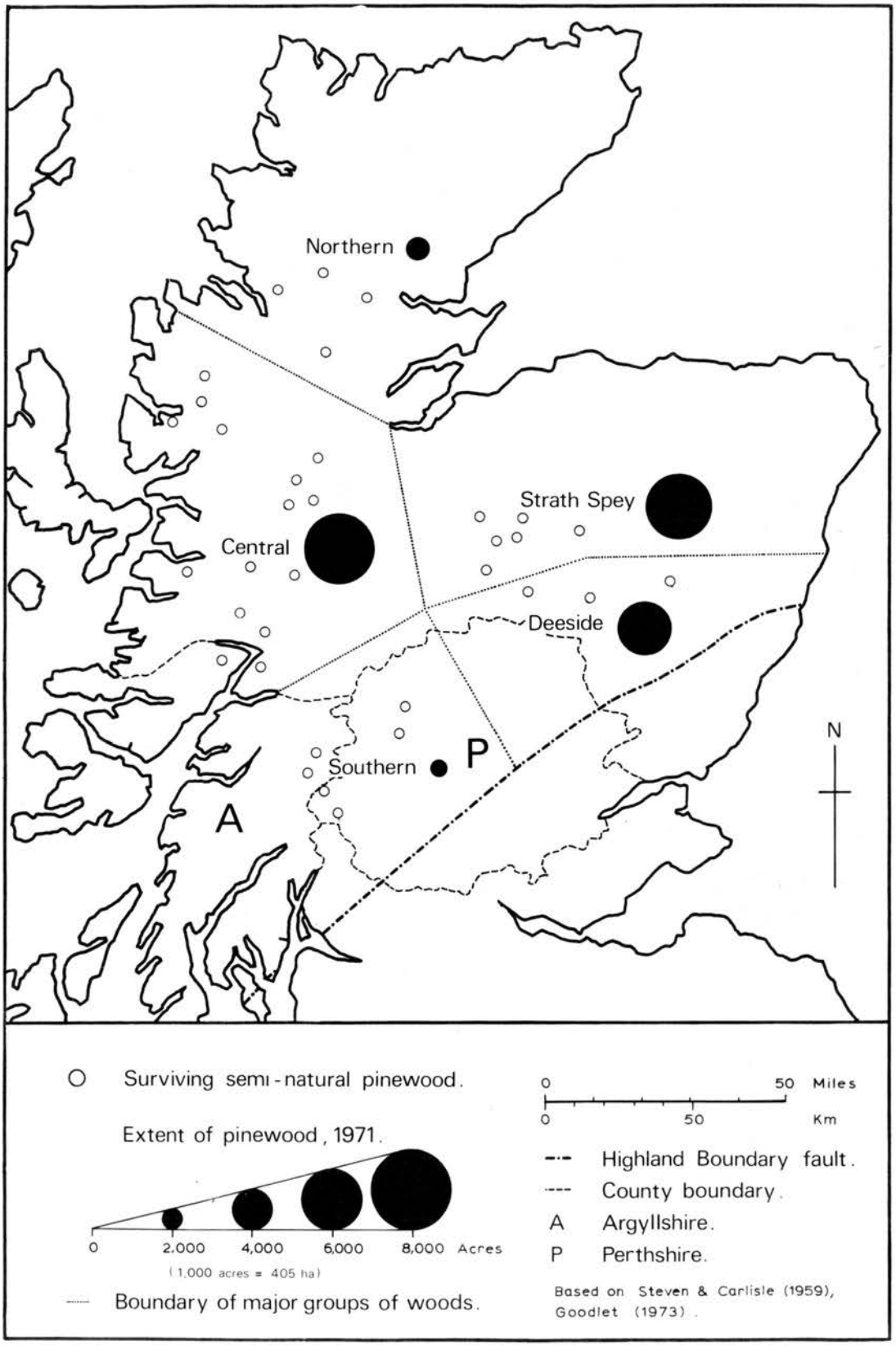


Figure 5.1 . The present distribution of semi-natural pinewoods in Scotland .

& Carlisle (1959) 84-5, McVean (1963a) 682-4). Since 1930 a number of attempts have been made to extend native pinewoods in different parts of the Highlands by assisted regeneration, but the process has been found difficult, uncertain and slow (MacDonald (1952) 31-2, McNeill (1955) 64-5, Henman (1961), 241-2); burning or ploughing of the chosen site and protection against grazing have been employed with a limited degree of success (McNeill (1955) 51, McVean (1963b) 24-5). The regenerative failure of pine in Scotland appears to be associated with the present form of pinewood communities.

McVean and Ratcliffe distinguished two major pinewood associations in Scotland on the basis of the dominant species of the field and ground layers. The first of these, in which the strata are dominated by species of the genus Vaccinium and mosses, is characteristic of relatively dense and pure stands of pine in the north and central Highlands but localised in the west. The second association, in which the field layer is dominated by heather (Calluna vulgaris) and bilberry (Vaccinium myrtilis) with patches of Sphagnum and other mosses, is typical of open woods and those with a greater proportion of birch and other deciduous species; woods of this type are generally found in the west Highlands and in eastern districts above c.900 feet (275 m) (McVean & Ratcliffe (1962) 11-14).

The structure of Scottish pinewoods seldom resembles the mixture of trees of all ages which might be expected if a steady process of replacement were maintained by regular regeneration; in Scottish conditions structure almost always takes the form of a mosaic of large or small sections, each of which is composed of trees of approximately equal age. McVean and Ratcliffe found three major forms. Dense even-aged stands are generally found in conjunction with the Vaccinium-moss association typical of the east. Two-generation stands in which trees of a younger age class surround closed groups of older trees contain both associations and intermediate forms; pine heaths consist of open groups of old trees of similar age over Vaccinium-Calluna or heathland associations (McVean & Ratcliffe (1962) 14-15). If the characteristics are taken together there is a general tendency for the eastern pinewoods to consist of dense pure even-aged or two-generation stands, and for those of the west and the eastern uplands to be open heaths or two-generation stands with a considerable proportion of deciduous timber.

Even-aged stands are common in virgin coniferous forest in the north temperate zone; such a structure indicates the presence of factors inhibiting regeneration except at infrequent intervals when the occurrence of mass regeneration gives rise to even-aged groups of trees (Jones (1945) 134-6, 141). Two-generation stands may originate in the same way. In the case of pinewood site conditions may inhibit regeneration; under pure pinewood mor humus

develops, which is relatively inactive biologically and therefore decomposes slowly. Tamm found that as the stand age of coniferous forest in north Europe increased mor became less active and therefore less suitable for pine regeneration; he attributed this largely to the absence of birch and noted that after a period under birch the quality of humus and litter improved sufficiently to allow regeneration of coniferous species (Tamm (1950) 183-4). Handley later found that in Scotland the evolution of mor rather than a more active litter depended on the available form of vegetable debris; he suggested that the presence of a proportion of deciduous trees could improve the litter of coniferous forest (Handley (1954) 92-3).

McNeill found that on an Aberdeenshire site natural regeneration of pine could be obtained only after a succession of deciduous species (McNeill (1955) 64). McVean has suggested that Scottish pinewoods in the past contained a higher proportion of deciduous timber and soil conditions more favourable for regeneration than at present, although in the seventeenth and eighteenth centuries the composition of pinewood may not have been unlike that of the present (McVean (1961) 300, McVean (1963a) 684). In conditions like those at present obtaining pine can regenerate effectively only if mor is re-activated by a more drastic means; windthrow and other forms of ground disturbances break up and aerate litter, but fire is the

most effective short-term means of preparing a site for the regeneration of pine (Jones (1945) 141-2, Tamm (1950) 181-3). McVean and Ratcliffe have suggested that all dense natural regeneration in Scotland at present is dependent on the burning of heather moor, although this may not always have been the case (McVean & Ratcliffe (1962) 15).

The beneficial effects of fire or ground disturbance are transient, and unless seedlings are rapidly established reduction in the activity of the litter and re-establishment of heather may prevent regeneration (Tamm (1950) 181-3, McVean (1961) 299); success depends on the occurrence of a good seed year, which generally takes place at intervals of four or more years, while the site is suitable for colonisation (Carlisle & Brown (1968) 285, 292). After establishment pine seedlings and new heather grow together, and grazing damage becomes a problem mainly when the young pines overtop the heather after five or more years, but they are capable of resuming growth quickly after being checked by grazing for several years (Carlisle & Brown (1968) 282). Young conifers are extremely vulnerable to fire, however, and mature pines may also be damaged or destroyed (Edlin (1956) 85-6, Carlisle & Brown (1968) 281-2). It is therefore vital for the success of regeneration that fire should not recur.

The decline of pinewood may be seen as part of a process of degradation in which woodland communities are replaced by vegetation and soils which do not permit

re-establishment of woodland. In prehistoric pinewoods the presence of deciduous species may have been associated with a relatively thin and active humus layer and regeneration of pine sufficient to balance mortality. In the more intensely oceanic periods woodland communities of all types were unable to survive on many sites; pinewood presumably remained on the more favourable sites, but when gaps were created in the woodland canopy increased light intensity would permit invasion by mor-forming species; creating a deep inert litter and a vegetation cover hostile to the growth of young pines except after fire or ground disturbance.

Pine would therefore decline slowly on the more favoured sites, but it is necessary to explain why a pioneer species like birch, which was already present in these woods, was not able to colonise these gaps and maintain a mixed structure. McVean has suggested that the decline of pinewood was the result of repeated burning, which opened the canopy and encouraged mor-forming heathland plants rather than the pioneer tree species (McVean (1961) 300). It may therefore be suggested that pine retreated rapidly from the margins of its range when oceanicity became more intense, and that gradual decline has taken place in the remaining woods as a result of anthropogenic pressure under oceanic conditions. Scottish pinewood has probably been subject to grazing and irregular burning throughout the historic period, and McVean

has taken both to be major factors in the creation of artificially pure and even-aged stands (McVean (1963a) 679).

Fire is likely to have been more significant in the initial degradation of pine stands, and is vital in creating conditions suitable for the mass regeneration which perpetuates even-aged stands. Some authors have accepted grazing as a primary factor, but it appears in general to be a secondary factor taking effect only when seedlings establishment has been permitted by other agencies (MacDonald (1952) 31-2, McVean (1963a) 677). After preparation of the site successful regeneration is possible in the absence of heavy grazing, although pines established without fire or on wet heaths and bogs grow slowly and are exceptionally vulnerable to checking by browsing animals (McVean (1963a) 680-1), Carlisb & Brown (1968) 292). The extensive sheep farming and systematic muirburn introduced in the late eighteenth century almost certainly reduced the possibility of regeneration, and their effects may in part account for the failure of regeneration after 1860 (Carlisle & Brown (1968) 281-2).

In the open pinewoods of the west the low density of mature pines may prevent mass regeneration in favourable conditions, although there is evidence of local regeneration after fire or ground disturbance; McVean has suggested that this pattern results either from poor regeneration in the long term or selective felling, which would remove the better potential parent trees and create

gaps suitable for colonisation by tall heathland plants and Sphagnum (McVean (1963a) 678, 683). The role of felling is not easily assessed; selective cutting would reduce stand quality but the opening of the canopy, ground disturbance, and burning of loppings after felling might permit localised regeneration if seed were available. Regeneration may have been poor in the west for a considerable time; it is evident that the free regeneration reported in the eighteenth century was confined largely to the heather moorland of the eastern Highlands (Steven & Carlisle (1959) 84-5).

The climatic distinction between east and west may therefore have had a continued direct effect; good regeneration was recorded in the final stages of a period, extending approximately from 1550 to 1850, during which climatic conditions in Britain and western Europe as a whole were severe and continental in character (Lamb (1959) 308-10). Conditions in the west Highlands may have differed from those of the east less markedly than at present and renewed oceanicity in the period after 1850 may provide an additional explanation for the general poverty of regeneration since then and the continued relative decline of the western pinewoods. McVean has suggested that the period of free regeneration was an interlude in a process of deterioration which was inevitable if burning, grazing, and sporadic exploitation was carried out in an oceanic climate (McVean (1963a) 684).

In view of the degree to which pine evidently declined in the Highlands before human action became significant, it may be suggested that climatic factors are of major importance, and that anthropogenic factors have accelerated rather than initiated an inevitable process of decline.

5.4 Trade in Highland pine timber

Early records of external trade in Highland pine timber are not common. There is some evidence of the carriage of timber from Inverness to the lowlands in the fourteenth century, and during the following two centuries the crown and army of Scotland occasionally ordered the cutting of timber in Lochaber, Glen Lyon and parts of Ross-shire (Anderson (1967) V.1, 146, 191-2, 207-8, 220); some of this was possibly pine. Military use of Highland timber continued during the seventeenth century, and although the commissioners of the English navy had a low opinion of the value of pine as mast timber, exigencies of supply compelled them to survey and occasionally extract timber from the eastern Highlands in the late seventeenth century (Anderson (1967) V.1, 323-4). When Kirk visited a pinewood in Easter Ross in 1677 the natives were hostile, believing that he had been sent by the king to have the wood felled (Brown, ed. (1892) 35).

There are also records of internal trade in pine timber before 1650. Some was sold in Inverness in the sixteenth century, and in other cases the rarity of pine

is indicated by the distance over which timber was carried (Mackay et al., eds. (1911-24) V.1, 130). When Bishop Brown of Dunkeld required timber for building in and around Dunkeld in the early sixteenth century supplies could be obtained from sources within a radius of ten miles (16 km), but spars and larger timber for a bridge at Dunkeld came from Rannoch and Glen Lyon, a distance of more than thirty miles (48 km) by river (Hannay, ed. (1915) 122, 129, 266); this timber was almost certainly pine. A number of sawmills existed in the Highlands by the late seventeenth century. Mills were in operation in Rannoch and Glen Lyon by 1675, producing deals largely for local markets (RPCS Ser.3 V.3 (1910) 448, V.4 (1911) 421). Sawmills were also said to be in operation in Strath Spey, Mar, and Lochaber at different times in the seventeenth century (Mitchell, ed. (1906-8) V.2, 106n, V.3, 241-3, Steven & Carlisle (1959) 107).

Pinewood was not always disposed of commercially in the seventeenth century, and in some cases timber was granted as a sign of favour. In 1618 John Taylor stated that the earl of Mar would give as much pine timber as required to any man regarded as a friend without payment; the woods of Mar were of high quality but too inaccessible to be commercially valuable (Brown (1891) 123). When MacDonald of Moidart required deals in 1668, his course of action was to obtain through acquaintances a warrant from the marquis of Huntly permitting the cutting of timber in

his pinewoods at the head of Loch Leven (SRO GD.16/34/197). In some cases timber was sold by tenants rather than the proprietor; according to a report of 1725 the population of Glen Tanar profited more from the sale of timber than from their holdings (Mitchell, ed. (1906-8) V.1, 106). The tenants may have been allowed access only to deciduous timber, but when the earl of Fife's case against the users of servitudes over the pinewood of Mar was stated in 1760, one charge was that much of the timber felled under servitude was sold in local markets (Michie, ed. (1901) 141-2).

The abortive attempt by the York Buildings Company to sell timber from Abernethy after 1728 is sometimes taken as marking the beginning of a phase of exploitation for external markets which reached a peak during the Napoleonic Wars and declined rapidly afterwards, but the history of felling is rather more complex (Ritchie (1921) 321, Darling & Boyd (1964) 70). Regular commercial felling for external markets appears to have developed first in the pinewoods of the west. Scottish pine timber was imported to Coleraine as early as 1611 and there was a continued demand from Ireland for west Highland pine until the early eighteenth century (McCracken (1971) 60, 78). An account of Ardgour in north Argyll, probably no later in date than 1655, states that masts, joists and cuts were regularly shipped from Cona Glen and Glen Scaddle to unspecified destinations (Mitchell, ed. (1906-8) V.2, 165). By 1705, according to Spreull, pine timber from the lands

of Lochinlel (probably Locheil) and the earl of Breadalbane was being shipped to the Irish ports in large quantities and also to Glasgow (Spreull (1705) 4). The woods in question were probably those of Locheil around Loch Arkaig and the Glen Orchy woods (below, 5.7).

The more extensive pinewoods of the eastern Highlands were utilised to meet local and regional demands before 1750, and some timber went to external markets. After that date, however, these woods became the principal source of native pine timber for the British market although much of the timber was still sold within the Highland area; when the wood of Glenmore in Strath Spey was purchased and felled by Hull merchants between 1783 and 1805 a considerable proportion of the finished timber went to Highland ports (Steven & Carlisle (1959) 113-4). Production was in general very small. In 1728 the York Buildings Company bought 60,000 trees in Abernethy for cutting over fifteen years, and the annual felling in Abernethy was apparently little over 10,000 trees toward the end of the century (SRO GD.248/135/1, Anderson (1967) V.1, 442); this may be compared with Scottish production of 1,150,000 tons of softwood in 1970, each ton representing at least one tree (Edlin (1969) 89). The eastern woods were also subject to intermittent and sectional cutting rather than prolonged systematic exploitation; commercial felling declined after 1815 and little was cut after 1850 (Nairne (1890-1) 198-9, Steven & Carlisle (1959) 95, 101-2, 107, 113-4).

The utilisation of Highland pinewood for external markets was therefore not a controlled process operating over a clearly defined period. Activity was most intense in the late eighteenth and early nineteenth centuries but pinewood was sporadically felled over a considerably longer period. The nature, extent and success of exploitation were dependent on a number of factors, the effectiveness of which singly and in conjunction was neither uniform nor constant. The area of pinewood fit for exploitation was very small; success required skilful use of the available markets, and much depended on the quality of the wood and the ease with which it could be delivered for sale.

5.5 Markets for pine timber

A number of factors are of general significance in determining the value of individual trees, and a marked homogeneity of character among the trees of an area of woodland will be important in determining the suitability of the area for exploitation. Size and regularity are the most significant aspects in general terms. Large straight timber is more efficiently and cheaply felled and extracted, in relation to production costs per unit volume. Such timber has similar advantages in the sawing process; a smaller proportion is lost as offcuts and waste, fewer operations are required to produce a given number of sections of timber, and there is greater flexibility in the dimensions and form of the finished product. Freedom from knots is desirable, and especially important

for certain purposes; here again timber cut from large trees is generally best, especially if grown in dense stands or well-managed plantations. Specialised markets may pay high prices for certain forms of timber, and if commercial markets can be found for brushwood, branchwood and sawmill refuse the profitability of operations is increased (Hiley (1954) 149-52).

Most timbers have characteristics which affect their suitability for different purposes. In Scotland pine was regarded as being coarse, soft and lacking in durability; it was therefore not thought valuable for some purposes, but markets were available in which the general regularity of form and suitability of pine for sawmilling outweighed these disadvantages. In the seventeenth century much was employed, in the form of deals and roughly-shaped 'trees' or joists, in the building and finishing of the timber-faced houses typical of the burghs of the period; other forms of construction within and outside the burghs also required pine timber and it was used to a smaller extent for masts, in boat-building and for mine timbering (Spreull (1705) 2, Smout (1960) 5-7). There was little change in the form of the market for pine timber in the period before 1850, although there were changes in emphasis and a general increase in consumption.

In the earlier part of the nineteenth century much of the domestically-grown pine available for sale was still cut into deals and scantlings for roofing, house

timbers, spars and struts (Monteath (1824) 232-3, Brown (1861) 240, Thomson, ed. (1864) 36). There was an increased and substantial market for small pine as pitprops in the mining regions of Scotland and the Tyne (Monteath (1824) 232-3). Domestic timber was used in shipbuilding at Garmouth and a few other points at the end of the eighteenth century and as late as 1845, and pine of high quality could still be sold as mast timber rather later (OSAS V.14 (1795) 395, V.20 (1798) 408, NSAS (1845) V.14 (Inverness), 368, Thomson, ed. (1864) 36). The manufacture of furniture required a variety of specialised woods, but pine was the timber most commonly used by cabinetmakers (Boaz (1814) 290). Highland pine was in a few cases cut for railway sleepers before 1850, but the major period of railway development in Scotland was in the second half of the nineteenth century (NSAS (1845) V.14 (Inverness), 368).

The principal uses of pine all required straight timber, and in most cases large dimensions added to the value of the timber; pitprops could be manufactured from stems as small as four inches (10.2 cm) in diameter, but timber for masts had to be tall, straight and strong (Monteath (1824) 232-3). The value of an area of pine timber in terms of the specific characteristics of the component trees was therefore largely determined by the quantity of large timber available; no market for crooked pine existed comparable to that for naturally

shaped deciduous wood (below, 8.1). The branches and brushwood of pine could be put to use locally but they had little commercial value; pine refuse could be sold as fuel but pine charcoal was unacceptable for some purposes and low in price (NLS MS.993, 13, Walker (1812) V.2, 287). The sale of small and crooked pine timber was therefore of little value in balancing the production costs of large timber.

In some ways the use of pine in the Highlands was unenterprising, and at least one possible use for refuse and pinewood of inferior quality appears to have been neglected. Spreull was surprised that no attempt was made in the Highlands to extract tar, pitch, and turpentine from pine timber; tar and pitch were imported in considerable quantities (Burns, ed. (1882) 64-5, Smout (1963) 157). In 1727 Defoe saw the manufacture of these items as a suitable means of utilising the less accessible native woods (Defoe (1724-7) V.3, 209). Tar and pitch were produced in large amounts in Scandinavia, and in parts of Finland tar was the staple forest product for export from the seventeenth until the mid-nineteenth century (Alho (1968) 200-3).

There was some controversy about the relative quality of pine timbers of different provenance, especially in the late eighteenth and early nineteenth centuries (Steven & Carlisle (1959) 229). Smith and others dismissed pine as 'the meanest tree in the plantation';

even those who favoured it agreed that slow growth and good seasoning were essential (Smith (1805) 149, Monteath (1824) 223-5, Brown (1861) 238-40). It was generally agreed that planted pine was inferior to the natural tree; the northerly position and slow growth of natural pinewood was thought to improve the quality of the timber, and this was reflected in the rather higher prices generally paid for native wood (Farquharson (1774) 266-7, Anderson (1967) V.2, 146-8, 278). Native pine was regarded as inferior to imported timber, however, or at best equal to it in certain circumstances (Monteath (1824) 224-5, Brown (1861) 238-9).

The native pinewoods were therefore only one part of a pattern of supply to the Scottish market; the relative importance of foreign and planted timber affected the development of trade in Highland wood. In the seventeenth century the main points of demand were the coastal and estuarine burghs of the central lowlands; later modification of the pattern reduced direct emphasis on coastal location, but the dominance of the lowland market remained unchallenged and was indeed reinforced by the increased concentration of population and industrial development in certain parts of the lowlands. The timber resources of central Scotland were negligible and external sources were consequently vital.

Regular import trade was established relatively early; boards were brought from north-west Europe in the

fourteenth century and by 1573 the supply of such 'eastland' timber was of sufficient national importance to permit the exemption of shipmasters bringing in such timber from the general embargo on the export of salt (Lythe (1960) 147). By the end of the seventeenth century timber had become the largest Scottish import in terms of bulk (Smout (1960) 3). At that time most of the supply came from the Baltic and Scandinavia and especially from Norway; most of the material was in the form of pine deals and semi-finished baulks, but cargoes were completed by a variety of specialised items, including barrel timber, crooked ship timber, and even fuelwood (Smout (1963) 154-6).

Some timber was imported even by the parts of the Highland fringe which were best placed to make use of local timber. In the late seventeenth century the customs precincts of Aberdeen and Inverness imported little enough timber to suggest that local supplies met most requirements, but the records of an Inverness merchant in the early decades of the following century suggest that only certain forms, including poor deals, were locally available (Mackay, ed. (1915) 26, 29, 47, 52, 89, Smout (1963) 143). The cost of imports in foreign exchange was seen as an incentive to use native resources; Spreull anticipated that if Highland pine and oak were to come on the market considerable savings could be made (Spreull (1705) 4). Timber merchants, perhaps more concerned

about their personal incomes than the requirements of the nation, do not seem to have responded to this stimulus.

Methods of extraction improved and plantation timber became available in bulk, but imports dominated the Scottish trade throughout the eighteenth and early nineteenth centuries, although there was some change in the pattern of supply. At the beginning of the eighteenth century Scandinavia and the Baltic were the main sources of pine timber and North America contributed only small quantities of specialised hardwoods (Smout (1963) 178). Norway and Sweden remained major suppliers of pine timber, but in the second half of the century Russia, Prussia and other parts of north Europe supplied between ten and twenty per cent of Scottish imports of pine (SRO RH.2/4 (4), RH.2/4(14), RH.2/4(12), RH.2/4(24), RH.2/4(26)). During the Napoleonic Wars demand increased greatly and established European trade was less easily maintained. Governmental tariff policy was directed towards the encouragement of import from Canada, and the results of imposition of a new scale of duties in 1809 were striking; the official value of imports of Canadian pine was as low as £2,715 in 1805 but rose to £36,020 in 1815 (SRO RH.2/4(34) 2-11, RH.2/4(42) 3-9, Anderson (1967) V.2, 285).

Imports were of continued importance after the war. Writing in 1824 Monteath emphasised that the timber requirements of Scotland and Britain as a whole were greater than could be met by domestic reserves, and that

another war would have disastrous effects unless reserves were improved. He proposed that the government should acquire land for planting, especially for naval oak (Monteath (1824) iv-x, xxvii-xxxiii). In 1914, however, Scotland still imported ninety per cent of her timber, and only the effects of another European war on domestic resources led to the formation of the Forestry Commission, almost a century after Monteath's proposal (Anderson (1967) V.2, 436, 498-9).

Comparison between the timber production of the Highlands and the level of imports recorded in customs ledgers for the period 1755-1827 is difficult. The official values employed in the ledgers were not directly related to market values, and although the quantity of timber imported in various forms may be obtained from this source, the corresponding quantity of timber available from felling in the Highlands is not known. During the peak period of exploitation in Strath Spey cutting was certainly large enough to support a large sawmill and a modest shipbuilding enterprise at Garmouth on the Moray coast (Smith (1954) 64-5, Steven & Carlisle (1959) 114). There is no evidence, however, that the availability of Strath Spey timber, which was probably during this period the largest domestic source of supply, had any definite effect on the balance between domestic and imported timber supplies to the lowland markets. Despite the enthusiastic forecasts of earlier observers the resources of the Highlands appear to have been swallowed by a huge

increase in demand when they were finally opened to exploitation on a commercial scale.

The dominance of imports also seems to provide a partial explanation for the lack of interest in Highland resources shown by Scottish merchants. The initiative in early development was taken in many cases by Irish and English merchants and even in the later exploitation of Strath Spey English enterprise and capital seem to have been dominant (Nairne (1890-1) 199, Steven & Carlisle (1959) 113, Anderson (1967) V.1, 440-2). Interest in Highland resources among Scots was perhaps stifled by the inertia of the import trade; Scottish merchants may have been unwilling to speculate outside an established pattern of trade and less sanguine than outsiders about the quality and extent of pinewood.

In the later part of the eighteenth century planted pine first became available for sale in bulk. As already noted, it was generally regarded as inferior to the native tree, but planted timber was more consistent in quality and plantations were generally better fitted for efficient felling; the quality of timber was uniform, systematic thinning yielded small stems suited to certain demands, and many plantations were near market areas. The importance of planted pine in the domestic market cannot now be assessed, and it is unlikely that this can be done accurately with surviving evidence. The crucial relationship, however, was that between native pine and imported timber.

Native pine had no specialised value to justify higher market prices even for particular uses, and appears to have been significant in the lowland markets only when external factors curtailed the imported supply or raised prices.

War conditions stimulated the use of Scottish material; the activities of privateers, strained or hostile relations with supplying countries, and the increased wartime demand for timber with a concomitant price increase all encouraged the use of domestic timber (Steven & Carlisle (1959) 114, Smout (1963) 145). Thus in the later seventeenth century the townspeople and rural gentry of lowland Angus were said to rely on imported deals, but when these became scarce or expensive, as in wartime, attention was temporarily turned to the produce of Highland sawmills (MacNair, ed. (1883) 21). The Napoleonic Wars were probably of great importance in raising timber demand and prices to the point at which domestic suppliers could compete in the national market. Despite increased use of Scottish timber, however, the long-term effect of wartime demand was the reinforcement of the dominance of imports and the development of a major new supply base in North America (Anderson (1967) V.2, 115-16).

The availability and price of imported timber at a given time would therefore have a critical effect on domestic timber exploitation. In the century after 1850 the dominance of imports in the British timber trade

increased to such an extent that only remote inland areas relied to any degree on domestic supplies; in the more remote areas standing timber could be sold only by selection of the best trees or sale in bulk at nominal prices (Hiley (1954) 161-2). Scotland, with a coastal concentration of market areas, was well placed for the early development of such a trend, and it is in some ways remarkable that the more inaccessible pinewoods were exploited at all. The purchase price of standing Highland pine must have been low enough in relation to market prices to allow merchants to cover the intermediate costs of marketing profitably, which suggests that in many cases proprietors were compelled to accept payment at little more than a nominal level. In the absence of reliable systematic data relating to the market price of imported and domestic timber, however, such a hypothesis cannot be adequately tested.

5.6 Other factors affecting the sale of pine timber

It has already been noted that Highland pinewoods commonly consist of mosaics of small even-aged stands, although the segregated structure of pinewood is in many cases not superficially evident, especially where selective felling has been practised (Malcolm (1957) 9-12, above, 5.3). At present the purest stands of pine are in Strath Spey and on Deeside, and pinewoods outside these areas generally have marked deciduous components (Steven &

Carlisle (1959) 68, 162, 174). Selective cutting for local use probably pre-dated commercial felling in most Highland pinewoods; this suggests that any resemblance to the regular and even-aged form obtainable in plantation would be farther reduced in many cases. Such woodland would not therefore approach the form most suitable to clear-felling, in which the timber of an area of woodland is approximately equal in age, of a single species or in segregated blocks, and suitable for sale in bulk to specific markets.

The native pine of the Highlands would also be unsuited to management as true selection forest, in which mature trees fit for felling are interspersed through a mixture of trees at all stages of growth and development, maintained in general by gradual natural replacement (Kö̈stler (1956) 212). Neither method is applicable unmodified to woodland of the form commonly found in Highland pinewood. Selective felling on silvicultural principles cannot easily be applied to a species which regenerates intermittently and therefore does not replace itself at a predictable rate. Clear-felling is traditional in British forestry and requires less skilled management, but inflexible application to irregular stands prevents the effective utilisation of the character of individual trees (Hiley (1954) 106-7, Kö̈stler (1956) 364); the crop may contain large numbers of trees too young or old to be sold profitably. Both systems also require large areas

for sustained operation on a commercial scale, and would therefore be inappropriate to the small and fragmented woodland of many parts of the Highlands.

Selective felling as outlined above is part of an integrated system of forest management, but selective felling can also consist simply of the exploitive extraction of the best timber without regard to the future of the stand. Such felling is essentially orientated to the market rather than to good management, and can impoverish an area of woodland relatively quickly by removal of the best potential seed trees, unless carefully controlled (Alho (1968) 208-9). Cutting of this type under varying means of control appears to have been normal in the felling of Highland pine for local consumption; small quantities were required at any one time, the users had time to select suitable trees, and the factors affecting profitability in marketing were subsidiary. Principles of management were far removed from those of modern European selection forest, and were in any case often abused; complaints that large pine and other marketable timber was regularly cut for trivial purposes were not unknown (above, 3.3).

There is little evidence of sustained selective felling of Highland pine for commercial use; the difficulties of Highland conditions and fluctuations in a market dominated by imported timber made intensive short-term exploitation more probable. As shall be seen later, selective felling was employed in Rannoch, which served

a limited and relatively stable local market (below, 6.3). It was also employed in the earl of Aboyne's Glen Tanar woods about 1725, and seems to have continued as late as 1797, when the skill of the fellers in choosing the largest trees was commended (Mitchell, ed. (1906-8) V.1, 107, OSAS V.19 (1797) 298-9). Operations in Glen Tanar were conservative in nature; even in 1797 the absence of a sawmill made it necessary to square timber by hand and therefore reduced the level of the annual income (OSAS V.17 (1797) 298-9).

As clear-felling and sustained selective felling were not directly suitable in Highland conditions a number of intermediate forms developed, based on a form of selective felling in which intensive cutting in the short term was combined with an element of selection based largely on the commercial value of timber rather than the requirements of silviculture. In some cases the purchaser was free to cut a given number of the best trees, much larger than would have been felled under a regime of selective felling, over a specified period (SRO GD.248/135/1); in other cases only young timber or trees below a specified size were excluded from sale (SRO SC.54/12/7 [a], GD.112/16/11 [a]). Such a form of sale gave some protection to small and immature timber, but also made it possible that old or distorted trees of limited value would be left; this danger was reduced to some extent by a modified form of sale in which the forester selected and

marked the trees for felling (Brown (1861) 503-4).

It is therefore evident that few areas of pinewood were immediately and completely cleared by commercial felling; except in cases where the stand was especially homogeneous a residue of immature, deformed or decaying trees would survive. The tendency toward mass regeneration on open ground adjacent to existing woodland suggests that the young timber would on the whole be in relatively compact areas, whereas the trees left uncut for other reasons would be scattered as pine heath in the former woodland areas. It was of advantage to the proprietor to conserve young wood, and in any case few markets existed specifically for small timber; the supply of pit-props to the mining districts of the south was maintained by the thinning of plantations more accessible to these markets (Monteath (1824) 232-3).

Although young trees were left the regenerative potential of woodland was considerably reduced by the removal of adult pines. Mature trees which survived because they were considered unfit for sale were likely to be old or inferior, and regeneration from their seed made possible deterioration in stand quality. The future of pinewood on the site of such quasi-selective felling depended largely on the quantity, quality and density of young timber. If immature trees survived in compact pure stands it was possible that deterioration in soil quality would prevent later regeneration in the wood; if

young trees were scattered over the site, however, it was possible that it would be invaded by deciduous species, or that the surviving trees would grow to form an unmanaged pine heath.

Timber is bulky and heavy in relation to value, and transport costs may be equivalent to the cost of growing marketable timber, even with a modern transport infrastructure and mechanised means of extraction and carriage (Hiley (1954) 91). This problem was even more marked before the advent of bulk rail carriage; overland transport was slow, expensive and limited in scope even in favourable conditions. Even if good cart roads were available such a mode of transport was unsuitable for the disposal of large quantities of timber. Water transport offered better opportunities; timber could be floated cheaply at a certain risk, and coastal shipping and canals allowed timber to be transported in considerable bulk, although some producing areas had no access to water carriage.

In the Highlands the problem of overland carriage was exacerbated by the deficiencies of the road system and the irregularity of the terrain. Four-wheeled carts were absent or rare in many parts even after 1800 (above, 3.5); railheads were established on the margins by 1850 but the development of an internal rail network was carried out largely after 1870 (O'Dell & Walton (1962) 206. Such circumstances emphasised the importance of water

transport, and in a number of ways Highland watercourses were suitable; sea lochs gave access to coastal shipping, especially on the west coast, and although few Highland rivers were navigable by craft of any size the gradients were steep and the elongated lochs were suitable for the marshalling and control of floating timber. Unfortunately, few Highland rivers, and none from the areas containing the largest pine reserves, flowed toward the lowland markets; they were also in general shallow, obstructed by rocks and rapids, and liable to seasonal fluctuation. Thus floating was feasible on the Dee only when the river was in flood, and the speed of flow at that time made control of timber difficult (Steven & Carlisle (1959) 93).

The importance of accessibility in determining the value of pinewood was frequently recognised by contemporary authors. Thus in 1618 John Taylor observed that the excellent timber of Mar was made useless by the roughness of the terrain and remoteness from water (Brown (1891) 123). In the first half of the seventeenth century the rivers of Cona Glen and Glen Scaddle in Ardgour were said to facilitate transport, whereas the pine of another glen running north from Loch Eil could be extracted only with great difficulty (Mitchell, ed. (1906-8) V.2, 159, 165). Describing the pinewoods of Ross, Defoe claimed that they were useless in the absence of water carriage (Defoe (1724-7) V.3, 209). Burt believed that the cost and difficulty of extraction would make even the pinewoods near the coast only marginally profitable, and those

inland totally unsaleable; he predicted that the York Buildings Company scheme would fail for this reason (Burt (1754) V.2, 6-7).

Pine was one of the least valuable timbers in terms of price per unit volume, and significantly higher prices could be obtained only for masts and other large pieces; difficulty of access and carriage was greatest in the case of such forms. Thus in the first half of the seventeenth century timber could be sold to Aberdeen from Pannanich Wood on the upper Dee only after rough-shaping into small sections for country use; the rapid flow of the river and the poor quality of the roads prevented the export of whole logs and trunks (Mitchell, ed. (1906-8) V.2, 284). Such difficulties were greater if timber was intended for external markets; sawmills were most efficiently sited where the product could be loaded for shipping, but this was not feasible if the floating of whole timber was hazardous and unpredictable. If sawmills were erected near the woods, however, the resulting deals and small cuts were more liable than logs to damage by rocks and water saturation, and timber suitable for masts and baulks could not be reduced in dimensions without a corresponding reduction in value.

It is clear that physical accessibility was a critical factor in the history of pinewood exploitation, and there are some grounds to support the statement that the key to success lay in the development of better

floating techniques in the early eighteenth century (Steven & Carlisle (1959) 58). The earlier exploitation of woods on the west coast may be attributed to their proximity to the sea; the Strath Spey and Deeside groups of pinewoods lay more than thirty miles (48 km) from the coast and other major areas were twenty miles (32 km) or more from the sea (Fig. 5.1). The inaccuracy of Burt's pessimistic forecast indicates that there was a radical change in the circumstances of east Highland operations later in the eighteenth century, however, and even the failure of the York Buildings Company venture may be attributed more to poor survey and management than to any fault intrinsic to the scheme (Murray (1883) 58-9).

Burt's statement referred more to economic than physical accessibility; he saw no way in which the cost of extraction in such conditions could be justified by the possible returns. Accessibility of this kind could be altered by reduction of extraction costs, but also by change in external factors; thus an increase in the market price would raise the threshold at which felling in difficult terrain became practicable. The assumption that exploitation could proceed only when effective methods of extraction were perfected ignores this aspect, and is founded on the belief that the cost of carriage itself was the main obstacle.

The development of satisfactory floating techniques took only a short time; with little or no previous

experience the agents of the York Buildings Company established a form of rafting in five years of timber working around 1730 which was still the standard floating method on the Spey after 1800 (Murray (1883) 57-63, Steven & Carlisle (1959) 113). The movement of timber in Strath Spey and other valleys was improved in the eighteenth century by deepening, straightening and damming of water-courses, but such improvements were on a scale which was scarcely beyond the technical and financial resources of the preceding century and had parallels in the timber operations of Rannoch and Glen Lyon in the late seventeenth century (RPCS Ser.3 V.4 (1911) 570, V.7 (1915) 46-7).

Physical accessibility was undoubtedly important, and if all else was equal woods with good access to markets had a distinct advantage; in some cases exploitation of pinewood was made possible by improvement of waterways and floating methods. Such improvements were instrumental in allowing the development of profitable felling, but other explanations must be found for the late development of exploitation; changes in physical accessibility were of a type which could have occurred considerably earlier. Alteration in market factors external to the Highlands were almost certainly significant, but another aspect of accessibility may also be considered.

Some indication has already been given of the social and political instability of the Highlands before the middle of the eighteenth century (above, 2.5). A num-

ber of specific aspects of this problem presented real or imagined threats to the security of timber operations in the region. It was not uncommon for contracts to include clauses by which the vendor guaranteed protection against or compensation for the actions of his own men and other parties. Thus in 1724, when selling timber near Kinlochleven to an Irish merchant, MacDonald of Achtriochtan included in the contract clauses promising compensation for molestation and theft by any party (SRO SC.54/12/10 [d]).

Such promises may have given merchants some reassurance, but the proprietors themselves were not always above suspicion. By one account Campbell of Glen Lyon sold his pinewoods in the late seventeenth century as a means of raising money in the short term and attempted to have felling stopped by legal action and force as soon as possible afterwards (Campbell (1886) 33-5). According to James Ray a group of Whitehaven merchants felling timber on Locheil's lands shortly before 1745 abandoned work and removed their equipment hastily after a dispute over payment, believing that Locheil was prepared to use force to support his claim (Ray (1752) 22, 106-7).

The degree of security enjoyed by merchants engaged in felling was therefore an important aspect of the trade in Highland pine, especially if the produce was to be sold outside the Highland area. If chiefs were unable to support their guarantees of protection against molestation,

or themselves hindered the progress of operations, merchants were put in a position which was virtually untenable as long as the civil and criminal code was not fully effective in the area. The effects of violence and obstructive tactics on the success of individual timber contracts can be assessed, but there is no means of calculating the number of merchants dissuaded from venturing into the region by factual information or tales of the dangers to be faced.

In such circumstances the deterrent effect of rumour and fragmentary information about the difficulties of Highland timber working may have been sufficient to reinforce pre-existing beliefs about the barbarity of the region in individual minds. It may be suggested that the real or imagined hazards of timber working in the Highlands formed a major obstacle to the development of trade, and that the expansion which occurred in the second half of the eighteenth century was based in part on a belief that these hazards had been nullified. The inertia of ideas may also have had a positive aspect; even if insignificant or unsuccessful, an individual enterprise may be copied rapidly by a number of speculative ventures. It is not improbable that such imitative development, which may have had little relation to real resources, had a place in the expansion of the timber trade in the Highlands.

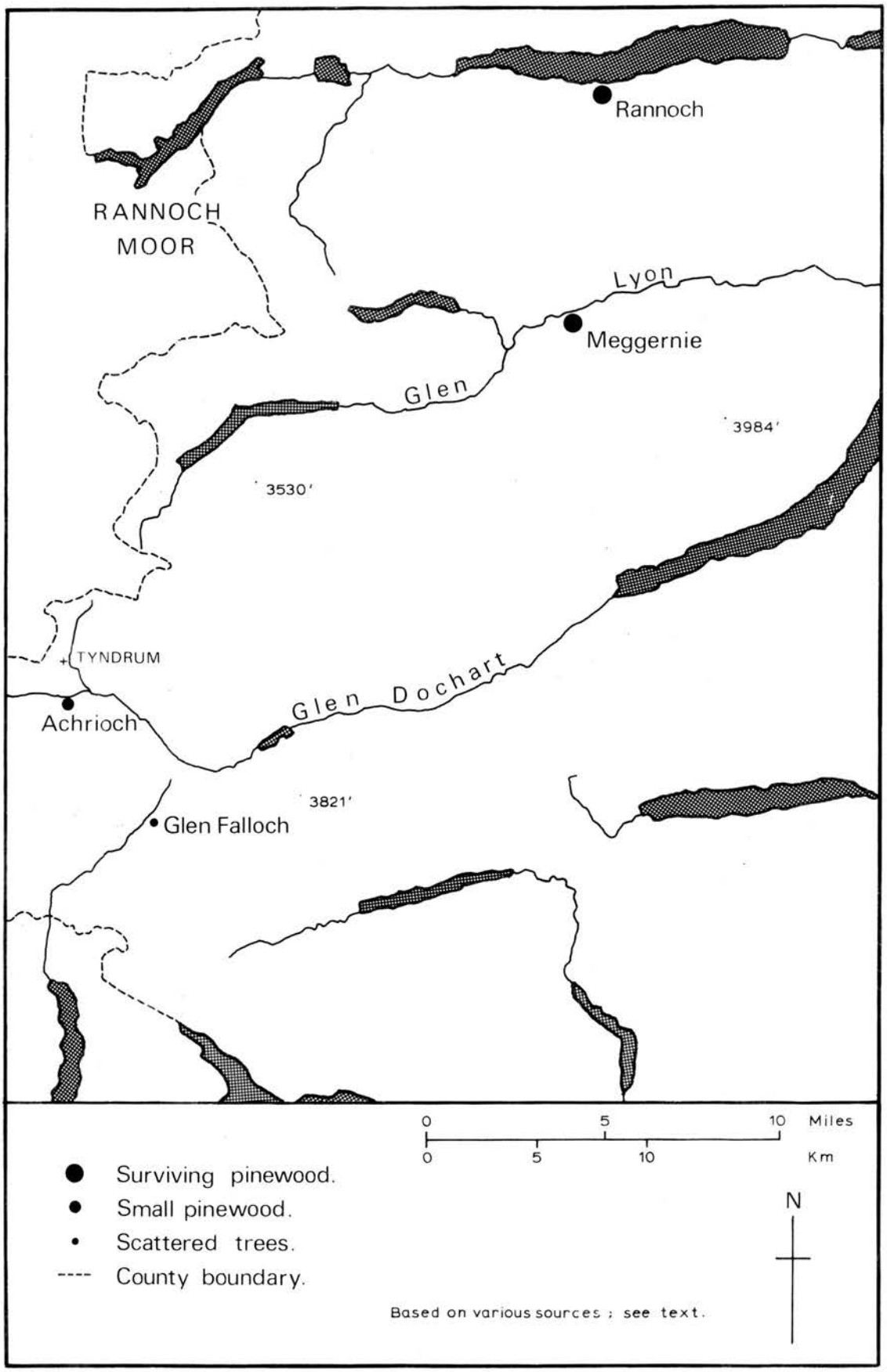


Figure 5.2. Semi-natural pinewoods in Perthshire.

5.7 The effect of commercial felling on pinewood in Perthshire and Argyllshire

Only four fragments of native pinewood survive in Perthshire at present; these are indicated by Figure 5.2. There is no definite evidence of the existence of others since 1650. Robertson stated in 1799 that native pine survived in some parts of the county, including the park of Finlarig at the west end of Loch Tay, but there are records of early planting and Steven and Carlisle consider that the pines now surviving in this vicinity cannot be accepted as native in origin (Robertson (1799) 236, Steven & Carlisle (1959) 136). The woods of Rannoch and Glen Lyon were almost certainly the sites of the sawmills from which lowland Angus obtained timber at times in the seventeenth century (MacNair, ed. (1883) 21). The largest body of surviving evidence relates to Rannoch, and shall be examined later (below, 6.1).

Glen Lyon runs parallel to Loch Rannoch and immediately to the south; both are on the upper Tay river system and have been recognised sources of pine timber at least since the fifteenth century; the use of Glen Lyon timber in the fifteenth and sixteenth centuries has already been noted (above, 5.4). A mid-seventeenth century account named two small pinewoods in Glen Lyon. The wood of Leakgaur, said to be three miles (4.8 km) long and one mile (1.6 km) wide, lay between Dalmoir and Balemoulyn, corresponding approximately to the present Old Wood of Meggernie between Moar and Allt Bail a' Mhuilinn. The

wood of Kreach na Keir, two miles (3.2 km) in both length and breadth, was ambiguously described but may have been on the lower Allt Conait at the west end of the Meggernie Wood; there are scattered pines on the site at present (Mitchell, ed. (1906-8) V.2, 563, Steven & Carlisle (1959) 145).

The first definite information about felling in Glen Lyon relates to the late seventeenth century. In 1671 or 1672 Campbell of Glenlyon leased the pinewoods of the estate and the existing sawmill to a certain Captain Crawford for twenty-one years. Disputes arose in 1677 and especially after Crawford's death early in 1678, when felling was continued by his partner, Stewart of Ballechin. The two parties later submitted conflicting statements to privy council. Glenlyon alleged that cutting by Ballechin during the year after July 1678 was totally unauthorised and that 8,000 trees had been felled; Ballechin claimed that Glenlyon and his men had removed a large amount of squared timber and papers relating to the contract, and taken forcible possession of the mill and woods in August 1679 (RPCS Ser.3 V.3 (1910) 448, V.5 (1912) 264, V.7 (1915) 46-7). A later and probably less reliable account stated that Glenlyon leased the wood to raise money for short-term requirements; in 1677 he found a pretext for legal action to stop felling but was anticipated by the burning of the sawmill by his tenants, who disliked Crawford and resented diversion of water from the corn mill of Eonan (Campbell (1886) 33-5). In 1681

privy council decided in favour of Ballechin, ordering Glenlyon to restore possession and to guarantee safety from farther illegal action (RPCS Ser.3 V.7 (1915) 47).

The existence of a sawmill before this contract indicates the regular sale of timber, and Glenlyon may have anticipated greater profit from extension of the market area; when agreement with Crawford had been reached he sought and obtained in 1672 a privy council order protecting timber floated on the Lyon and Tay (RPCS Ser.3 V.3 (1910) 448). Local sale was evidently resumed in the following century, when the wood became part of the estate of Culdares; in 1751 Sir Robert Menzies of Menzies described a large pinewood in Glen Lyon which had been exhausted by extension of the haggs or annual cuttings (SRO E.783/14/2). In the circumstances exhaustion probably meant removal of marketable timber rather than total clearance of the site; the Military Survey indicates that open woodland covered the site of the present Old Wood at the time when Menzies made this observation (MS.(1747-55m) 15/2, 16/4). The wood may have been allowed to recuperate in the later part of the century; Stobie's county map indicates that it was little different in 1783 from its present dimensions but there is no evidence of commercial use. Rannoch supplied local markets with pine timber but little went to the upper part of Glen Lyon, and timber from the wood of Meggernie may have been used on the estate (Stobie (1783m), Fig.6.5).

In 1799 both natural and planted pine timber were advertised for sale at Meggernie (Anderson (1967) V.2, 62). Response to the advertisement is not known but there is no evidence of later commercial felling and the preponderance of old trees in the present Old Wood suggests that it remained largely untouched (Steven & Carlisle (1959) 147). Even in the seventeenth century the wood was small in dimensions and inaccessible; floating down the narrow and tortuous course of the Lyon was the only feasible means of extraction. It is possible that the wood was over-exploited in the early eighteenth century, and recovered too late to be of renewed commercial value.

Less is known about the history of the remaining two small fragments of pinewood in Perthshire, Coile Coire Chuirk at Achrioch near Tyndrum and a group of trees in upper Glen Falloch near Crianlarich. Both were on a regularly-used route but neither seems to have attracted the attention of travellers, although pine was recorded at Achrioch in the middle of the seventeenth century (Mitchell, ed. (1906-8) V.2, 534). The Achrioch wood is fifteen miles (24 km) from the head of Loch Lomond, and water transport could be used only on the second half of the southward journey. There is some evidence suggesting local use of Achrioch timber. Lead was mined near Tyndrum after 1741 and regularly until 1791; intermittent attempts were made to re-open the workings in the first half of the nineteenth century. Smelting

methods of the time did not use charcoal but timber was used for structural support; the earls of Breadalbane granted the Tyndrum miners a supply of timber for this purpose, accepting payment only to cover the costs of felling and carriage (Smout (1967) 105, 108, 111-12). The main workings were no more than three miles (4.8 km) from Achrioch, and although there is no positive evidence this was probably the source of timber.

The present wood occupies rather less than one square mile (259 ha) at the foot of the River Cononish (Steven & Carlisle (1959) 225). The Military Survey indicates that it was little larger in 1750; scattered trees extended for approximately three miles (4.8 km) up the south side of the river but may have been birches, which are present in the modern wood (M.S. (1747-55m) 14/4). In 1783 the wood was comparable in area to the present pinewood (Stobie (1783m)); there is therefore some reason to doubt the accuracy of Robertson's slightly later observation that the 'considerable tract' of pine-wood near Tyndrum had almost gone (Robertson (1799) 236).

Very little is known of the Glen Falloch pines; at present they form an open pine heath of scattered old trees without evidence of regeneration (Steven & Carlisle (1959) 227). There is evidence that such a pattern is not entirely a recent development; the Military Survey marked a small group of trees in the appropriate position, and in 1804 Thornton took the few straggling pines of Glen

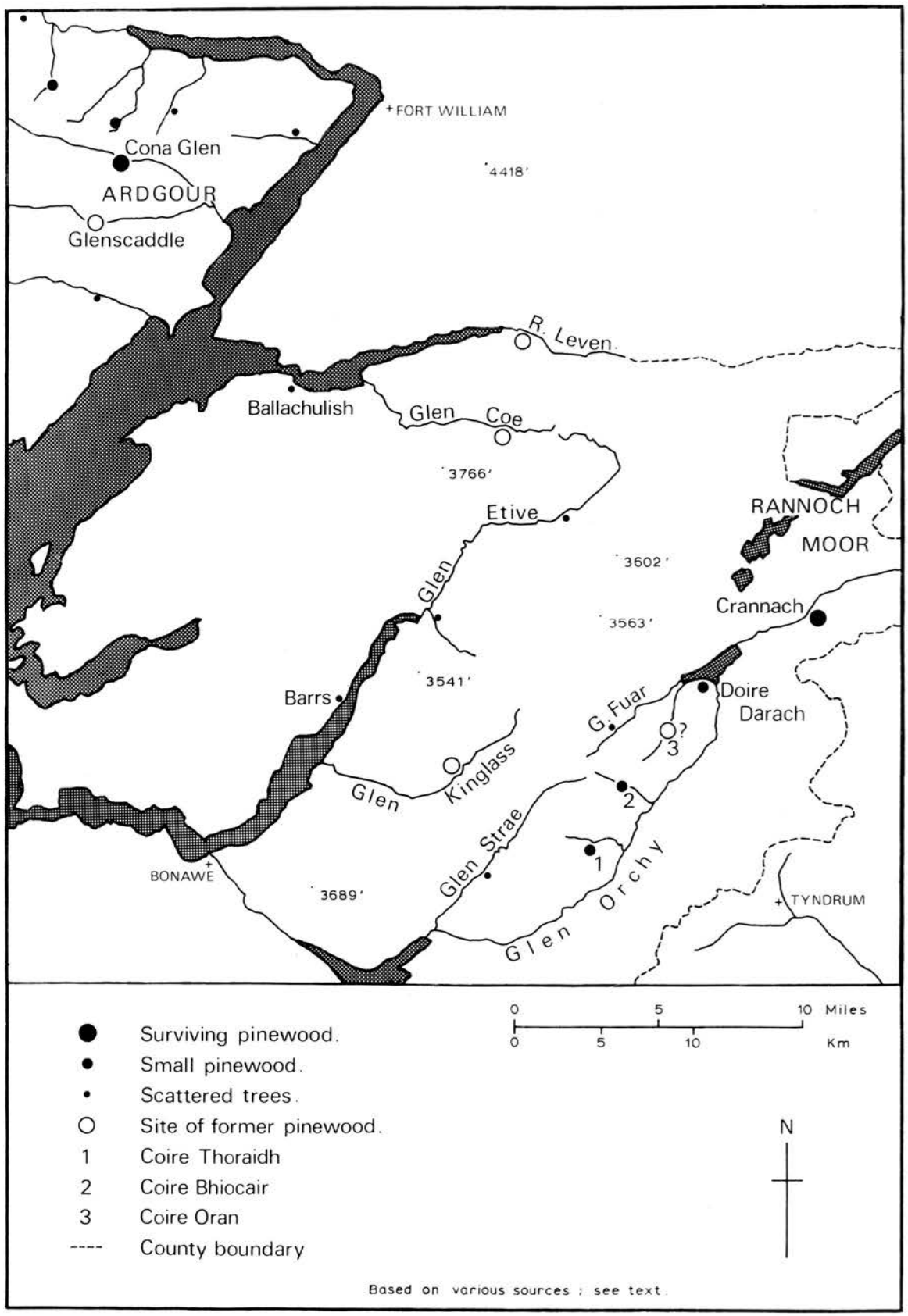


Figure 5.3 Semi-natural pinewoods in Argyllshire.

Falloch as an indication of the poverty of the district (M.S. (1747-55m) 15/3, Thornton (1804) 54).

The native pinewoods surviving in Argyll during this period, with the exception of Ardgour, consisted of a series of small and scattered fragments in the valleys radiating from Rannoch Moor. These included sections in and around Glenorchy, near Loch Etive, in Glen Coe and around Loch Leven (Fig. 5.3). During the period scattered trees and small groups of pines were also seen in parts of Rannoch Moor itself by a number of travellers (Pennant (1771) 183, Anon. (1819) 138-40, MacCulloch (1824) V.1, 320). Dead and moribund old pines remain on an island in Lochan na h-Achlaise, in association with a group of trees which indicate regeneration within the last century (McVean (1958) 200-1).

In 1705 the earl of Breadalbane was said to be selling pine timber, largely to Ireland (Spreull (1705) 4); the most likely source for this timber on his lands was the woodland in and around Glen Orchy. In 1723 the Breadalbane commissioners sold the pine woods of the barony of Glen Orchy and the deciduous timber of other lands for £1,000 sterling to the Irish partnership of Arthur Galbraith and Roger Murphey, who had an interest in the tanning trade and the ironworks in Glenkinglass (below, 10.5). Fifteen years were allowed for cutting; the pinewoods of Glen Strae and Corrueran were excluded from sale, and on other lands cutting was to be confined to

trees larger than two feet (61 cm) in circumference three feet (91 cm) above the ground (SRO GD.112/16/11 [a]).

In August 1725 the earl visited the woods and was alarmed by the poor standard of cutting. The contract required that the cutting of any one block should be carried out as a single operation but only the best and most accessible trees had been selected for felling and repeated cutting on the same sites endangered young growth. The choice of minimum circumference, for which the earl himself had been responsible, had proved to be a gross error; even the smallest trees in the woods were greater than thirty inches (76 cm) in girth, and the contract therefore offered little protection to young growth (SRO GD.112/16/11 [b]). The earl wished to have the contract annulled but work continued, perhaps on modified terms; in 1726, however, the original partners evidently encountered financial difficulties and there was a complex series of assignations of shares in the contract (SRO SC.54/12/10 [e], SC.54/12/11 [d]).

Murphy retained an interest in the woods until his death in 1731, but Galbraith sold his share to Sir Duncan Campbell of Lochnell about 1727. In January of 1730 Campbell of Carwhin described the Irish partners as 'notour Bankrupts' and informed the commissioners that he was taking action against Murphey and Lochnell in relation to a breach of the tack; this may have concerned payment of rent for farms leased under the contract,

which was the source of continual friction. He also observed that the woods were poorly supervised and freely used by everyone on the estate (SRO GD.112/16/11 [c]); in 1726 the partners had made an agreement with two local men who were to protect the woods against abuse during the period of cutting, but the terms of this agreement were evidently no longer observed (SRO SC.54/12/12 [a]). Cutting continued until 1738, but Lochnell and Alexander McMillan, the partners during the later period, assigned the woods to Provost Fisher of Inveraray shortly before the contract expired (SRO GD.112/16/11 [d]).

The felling under this contract may have been the last commercial use of the pine of Glen Orchy, and certainly left a lasting impression on local memory; the two Statistical Accounts and Smith's general survey of the county all contain descriptions of the former extensive pinewoods of the district and the destruction caused by the Irish company (OSAS V.8 (1793) 539-40, Smith (1805) 137, NSAS (1845) V.7 (Argyll), 92). At least one more attempt was made to sell timber from Glen Orchy; in 1808 50,000 cubic feet (1,400 cu.m) of old natural pine timber were advertised as being available in specific woods, and in 1809 10,000 feet (280 cu.m) were advertised in one of them alone (Anderson (1967) V.2, 62). This was not a large quantity; 50,000 cubic feet of timber could be obtained from about 3,750 reasonable trees or 1,000 exceptional specimens (Anderson (1967) V.2, 63, below, 6.3).

There is no evidence that the advertisement was successful; the 1845 account described the activities of the Irish company, the location of existing woods, and the cutting of pine for local use about 1810, but made no mention of any second phase of commercial felling (NSAS (1845) V.7 (Argyll) 92).

The plotting of change in the area of pinewood around Glen Orchy is difficult. In 1726 the woods were described as lying between Stronmilchan and the end of Crannich (SRO SC.54/12/12 [a]). Stronmilchan is at the foot of Glen Orchy and Crannich was probably the present wood of Crannach east of Loch Tulla; with the exception of Glen Strae, which was in any case reserved from sale, the whole group of surviving pinewoods lies between these points. The Military Survey is of little value in this case, providing only a pattern of scattered and ambiguous symbols (M.S. (1747-55m) 14/4, 15/2).

The advertisement of 1808 named Cronich (the modern Crannach), Glenfua (Gleann Fuar), Corryriggar (Coire Bhiocair) and Corrychorry (Coire Thoraidh) (Anderson (1967) V.2, 62). The 1845 account named the same areas as including pinewood, and added Doire Darach on Loch Tulla; this wood was described by a traveller in 1818 as being largely rotten with age, and may have been thought unmarketable ten years previously (Anon. (1819) 135, NSAS (1845) V.7 (Argyll), 92). Pine remains at present in the same woods of Coire Bhiocair, Coire Thoraidh (or Allt Broigh-

leachan), Doire Darach and Crannach; there is scattered pine and birch in the upper part of Gleann Fuar and a small amount of pine in Glen Strae (Steven & Carlisle (1959) 217-24).

The Glen Orchy woods are not readily accessible; the surviving areas are in small side valleys or relatively far inland, and Crannach is over thirty miles (48 km) from the shipping point at Bonawe. The disadvantages of these woods for commercial use must therefore have been strong, and it is not surprising to find that the contractors preferred to cut selectively. They were able to reduce freight costs by selling some timber locally (SRO SC.54/12/11 [c]); the terms of the contract and unreliable later evidence suggest that they also attempted to coal pine timber for use in the Glenkinglass ironworks (SRO SC.54/12/10 [e], NSAS (1845) V.7 (Argyll), 472-3). The effects of the contract of 1722 cannot be assessed, however, without more knowledge of the area of woodland existing before that date.

Contemporary and later accounts emphasise that the standard of felling was poor, and that the contract offered less protection to young timber than was intended. It may be noted, however, that there is no definite evidence of a major reduction in the area of pinewood, and that the woods reserved from sale in 1722 have since declined. According to the 1845 account the last of the pine in Glen Strae was cut about 1810 for the building of

a church; a few trees survive but they comprise the smallest remnant among the identifiable Glen Orchy woods (NSAS (1845) V.7 (Argyll), 92, Steven & Carlisle (1959) 217). The other wood reserved from sale in 1722 was Corrueran, which cannot be identified conclusively from manuscript or printed maps of the period or early Ordnance Survey maps. Smith in 1805 mentioned a pinewood at Coire uarain, a variation which suggests a location in Coire Oran southwest of Loch Tulla; by 1870 only a very few isolated trees survived on that site (Smith (1805) 156, OS 6" A76 (1870m)).

There is evidence of the survival of pine along Loch Etive and in Glen Etive, to the northwest of Glen Orchy; most information relates to Glenkinglass, where no pine now remains. In 1845 the minister of Ardchattan parish claimed that the excellent pines of the glen had largely been felled and coaled a century previously by Irish iron-smelters working there, and that the remainder has since been felled (NSAS (1845) V.7 (Argyll), 472-3); a scattering of pines remained near Doire nan Saor in the upper part of the glen as late as 1870 (OS 6" A75 (1870m)). There is no direct evidence to connect the Irish company with the cutting of pine in Glenkinglass. The contract by which Lochnell leased land for the ironworks may have included provisions for the supply of timber, but is no longer extant; a contract of 1721 between Lochnell and Roger Murphey permitted the cutting only of oak and other

deciduous timber in the glen (SRO SC.54/12/11 [b]).

Whether or not the company felled pine, it is evident that little remained by 1752 , when the Lorn Furnace Company leased lands and woods from Lochnell. Under these contracts the pinewood was reserved, but a clause of the second contract of 1752 obliged Lochnell to grant the company the best pine tree in the glen gratis, and to share the extraction costs and value of sixty of the best trees (NLS MS.993, 1-4, 32). Lochnell therefore retained control of the pinewood, but the small quantity named in the contract suggests that very little remained at the time. The terms of the contracts excluded the possibility that the furnace company might coal pine timber, and their surviving records, for the period 1786-1812, do not indicate that their occasional dealings in whole timber included the sale of pine from Glenkinglass (below, 11.6).

Under another contract of 1752 the company leased from the earl of Breadalbane the woods of certain lands on Loch Awe, with the farms of Barrs, Inverghiusachan, Glen Noe and Duo on Loch Etive; pinewood was reserved from sale (NLS MS.993, 8-9). A few of the islands of Loch Awe contain pine which is possibly of native provenance, but there is no other evidence of native pine in the area except a fragment at Barrs (Steven & Carlisle (1959) 217). More may have existed at one time; Smith observed that Glen Etive, like Glen Orchy, was one of the last refuges of native pine in the county, and groups of trees remain

at two sites in Glen Etive, on the lower Allt Mheuran and above Alltchaorunn (Smith (1805) 156, Steven & Carlisle (1959) 217). With the possible exception of Glenkinglass, however, there is no evidence that the pine of Glen Etive was extensive enough to be of commercial value.

Pinewood has also gone from Glen Coe, although a little survives above Ballanchulish near the mouth of the glen (Steven & Carlisle (1959) 217). A letter from Lord Stonefield to an unspecified person in 1728 noted that a proprietor, probably in Appin or Benderloch, had laid claim to the Glen Coe pinewoods and intended to cut them; Stonefield thought that the woods were probably reserved to the duke of Argyll under the Glen Coe charter (SRO GD. 14/10/1, 100-1). At the end of the century the only pine in the glen was a small scattering in the upper part, ignored by some travellers but described by Newte and Wordsworth (Newte (1791) 118, Shairp, ed. (1874) 173). The Military Survey sheet depicts extensive woods in the lower part of the glen, where deciduous woodland remains at present, and scattered trees on the south side of the upper glen, perhaps on the lower slopes of Gearr Aonach (M.S. (1747-55m) 14/5).

Native pinewood also seems to have gone from Loch Leven, although formerly existing both on the Inverness-shire side of the loch and on the River Leven to the east. A manuscript map attributed to Pont and therefore probably produced before 1600 shows trees for some distance along

the south side of the River Leven immediately east of the loch, with the phrase 'Many Fyrre Woods heir alonge' (NLS (M) EMS.b.4.3, 13, Cash (1907) 579). As already noted, MacDonald of Moidart requested pine timber from the wood at 'the head of Leivine' in Lochaber in 1668 (SRO GD.16/34/197). A manuscript sketch plan of Loch Leven and Glen Coe produced about 1745 included 'firr wood' on the south bank of the river about three miles (4.8 km) above the loch, and Dorret's map of Scotland named 'Corrienamor Firwoods' on the Leven, a name perhaps derived from Coire Mhorair on the south side (SRO RHP.6796, Dorret (1750m)).

Both the Military Survey and early Ordnance Survey maps of 1870 depicted open woodland on the lower part of the river and in tributary valleys, including Coire Mhorair; the Ordnance Survey maps indicate that pine had disappeared from the Argyll side and existed only at a few points on the north bank of the river (M.S. (1747-55m) 14/5, OS 6" A32 (1870m)). There is little documentary evidence about the woods. In 1724 MacDonald of Achtriochtan sold to an Irish merchant the birch wood and other timber of Kinlochbeg, which then lay about one mile (1.6 km) above the river mouth on the south side; pine and oak above a certain circumference were reserved from sale, and the contract appears to have been intended to preserve the better timber for separate sale (SRO SC.54/12/10 [d]). Such a contract, encouraging removal of young timber, may

have had a considerable effect on future regeneration, especially if the mature trees were also sold under another contract. There is no definite evidence that commercial felling destroyed what was evidently once a large pinewood, but it may be noted that the site was well placed for access to shipping and may therefore have been exploited relatively early for the Irish market.

Finally the pinewoods of Ardgour may be considered. The timber of Cona Glen and Glen Scaddle was being floated down the rivers and exported in some quantity in the middle of the seventeenth century, but it is evident that little marketable timber remained in the early eighteenth century (Mitchell, ed. (1906-8) V.2, 165). In 1713 MacLean of Ardgour sold to a merchant of Tarbert in Kintyre all the pinewood of Cona Glen and Inverscaddle with the oakwood of Inversanda and other lands; as the contract was only for a period of four years and total payment was no more than £40 sterling it is apparent that little timber of commercial value could be found (SRO SC.54/12/7 [a]). Young trees were reserved if smaller than six inches (15.2 cm) square (approximately eight inches (20.3 cm) in diameter) at a height of five feet (1.5 m) above the ground. There was also an unusual clause permitting the removal of timber which was lying cut in the wood or in the water 'throw any inconvenience' when the contract expired, although a seventeenth century observer had noted the particular value of these rivers for extraction (SRO SC.

54/12/7 [a], Mitchell, ed. (1906-8) V.2, 165).

There is no concrete evidence of felling after this time. By 1793 the parish of Ardgour (Kilmallie), in which lay both the Ardgour woods and Locheil's pinewoods around Loch Arkaig, was regularly importing timber; this was explained by the minister as resulting from the remoteness of the woods from the shore (OSAS V.8 (1793) 422-3). Such an explanation may have been appropriate to commercial felling; between 1794 and 1808 relatively small quantities of timber were repeatedly offered for sale by Locheil in terms which suggest that purchasers were not easily found (Anderson (1967) V.2, 58-9). The obstacle of high extraction costs would be smaller if the timber was to be used locally, however, especially if the intending user was able to supply his own labour and was not affected by commercial market prices; the unavailability of local timber may therefore have resulted from scarcity or from a policy of strict conservation.

Cartographic evidence is unsatisfactory; accurate maps are available only for the period in which there is no evidence of commercial use. The Military Survey indicated scattered woodland in most of the valleys of Ardgour, and considerably more in Cona Glen and Glen Scaddle than at present, although in more fragmented form and of uncertain species (M.S. (1747-55m) 12/5-6, 23/1). The Langlands county map is too poor in this section to be of any value, but a plan of Cona Glen and north Ardgour

made in 1858 contained a pattern of woodland crudely drawn but resembling that of the present (RHP.747/1, Langlands & Langlands (1801m)). In 1870 wood was more widely distributed than at present but basically similar, with compact areas of mixed woodland and scattered clumps of deciduous and coniferous trees; in 1870 as at present almost no pine survived in Glen Scaddle, which had been commercially valuable in the seventeenth century (OS 6" A10, A19 (1872m), Steven & Carlisle (1959) 173).

It is unfortunate that so little information is available about Ardgour; the district contains a large number of scattered sections of pinewood, and there is no evidence that the timber of the minor valleys was commercially used; more information would therefore permit comparison between areas subjected to commercial felling and those in which domestic pressures were perhaps dominant. Present evidence suggests that here, as in Glen Lyon, a period of exploitation beyond the regenerative capacity of the wood reduced commercial value, and was followed by a slow recovery; in this case, however, recovery appears to have been unsatisfactory and fire may have been a factor in this. In May 1729 MacLean of Ardgour complained of severe fire damage to oak and other valuable timber trees throughout Ardgour in the previous month (SRO GD.14/10/1, 321-2). As already noted, young and mature pines are vulnerable to fire; burning may prepare a site for regeneration, but only in certain circumstances can

regeneration be expected to succeed (above, 5.3).

Evidence about the decline of pinewood in Perthshire and Argyllshire remains inconclusive, and there is no definite evidence that woodland was destroyed by commercial felling. Commercial cutting would provide an explanation for the rapid decline of the Loch Leven woods but the information necessary to support such an explanation is absent. In the case of the Glen Orchy woods, however, areas of pine subject to exploitive and careless felling in the eighteenth century appear to have survived as well or better than sections reserved from sale. The examples of Ardgour and Glen Lyon may provide some insight. In both cases commercial felling appears to have been halted by the inability of the wood to replace the quantities felled; the wood of Glen Lyon later returned to a state in which it was of some commercial value, but the more westerly wood appears to have suffered permanent depletion.

McVean has suggested that Scottish pinewoods are declining as the result of a process of degradation inevitable under a regime of continued grazing, burning, and irregular felling (McVean (1963a) 684). Such a process is most strongly developed in the western parts of the Highlands where the climate is markedly oceanic. In the absence of felling the process may be very slow; the pine heath of Glen Falloch appears to have changed little in almost two centuries. Where commercial felling has taken place, however, degradation has been accelerated,

although exploitation of the small woods of the west appears to have been halted relatively rapidly by the reduction in value and decrease in accessibility of the surviving timber; the cessation of cutting has been followed by slight recovery or a continued slow decline.

5.8 Summary

The extent of native Scots pine in the Highlands was greatly reduced before the beginning of the historic period and by 1650 the distribution and extent of the species were little different from those of the present. Mass regeneration in certain conditions is characteristic of the species, which prefers semi-continental conditions; regeneration is therefore intermittent and has been notably poor since 1850. The decline of pinewood in the historic period may be attributed to sustained anthropogenic action under unfavourably oceanic conditions.

Felling for external markets took place in the west Highlands before 1750; between then and 1850 attention was concentrated on the east Highland pinewoods, but even there resources were small and felling intermittent. Domestic pine timber was generally able to compete in the Scottish market only when imports were temporarily unable to meet demands. Exploitation was more characteristic than management, and the structure of pinewood encouraged a form of selective exploitation. Access and the structure of pinewood encouraged a form of selective exploitation. Access was a severe but not insuperable problem; the

expansion of felling after 1750 seems to have resulted from improved market factors and greater stability in the Highlands rather than improved physical accessibility.

Examination of evidence relating to the small pinewoods of Perthshire and Argyllshire cannot provide definite conclusions, but commercial felling appears to have accelerated the slow process of decline when it occurred; when a reduction in the value of the remaining timber brought felling to a halt there was a slight increase in stand quality or a resumed slow decline.

CHAPTER SIX

THE COMMERCIAL USE OF THE WOOD OF RANNOCH, 1749-84

6.1 Introduction

The only pinewood in Perthshire or Argyllshire which provided a regular income from felling in the seventeenth or eighteenth century was that of Rannoch. The term 'Black Wood' was applied to it by the middle of the eighteenth century, but relates specifically only to the compact central section of the pinewood (SRO E.783/76/9, E.783/98, 24). The wood lies along the south shore of Loch Rannoch in Fortingall parish in northwest Perthshire, rather more than forty miles (65 km) from Perth by road or water (Fig. 6.1). Until the end of the eighteenth century the remoteness of the wood from the lowlands was accentuated by the difficulty of access from the Tay valley; inaccessibility and the tolerant attitude of the proprietor made Rannoch notorious as the home of refugees from justice in the early eighteenth century, and a military garrison was established at the west end of the loch after 1745 (SRO E.783/84/1, Allardyce, ed. (1888) V.1, 31-4).

The wood at present occupies part of an arcuate belt of relatively low altitude and gentle slopes between the loch and the mountains which separate Rannoch from Glen Lyon to the south. Pinewood extends from the level of

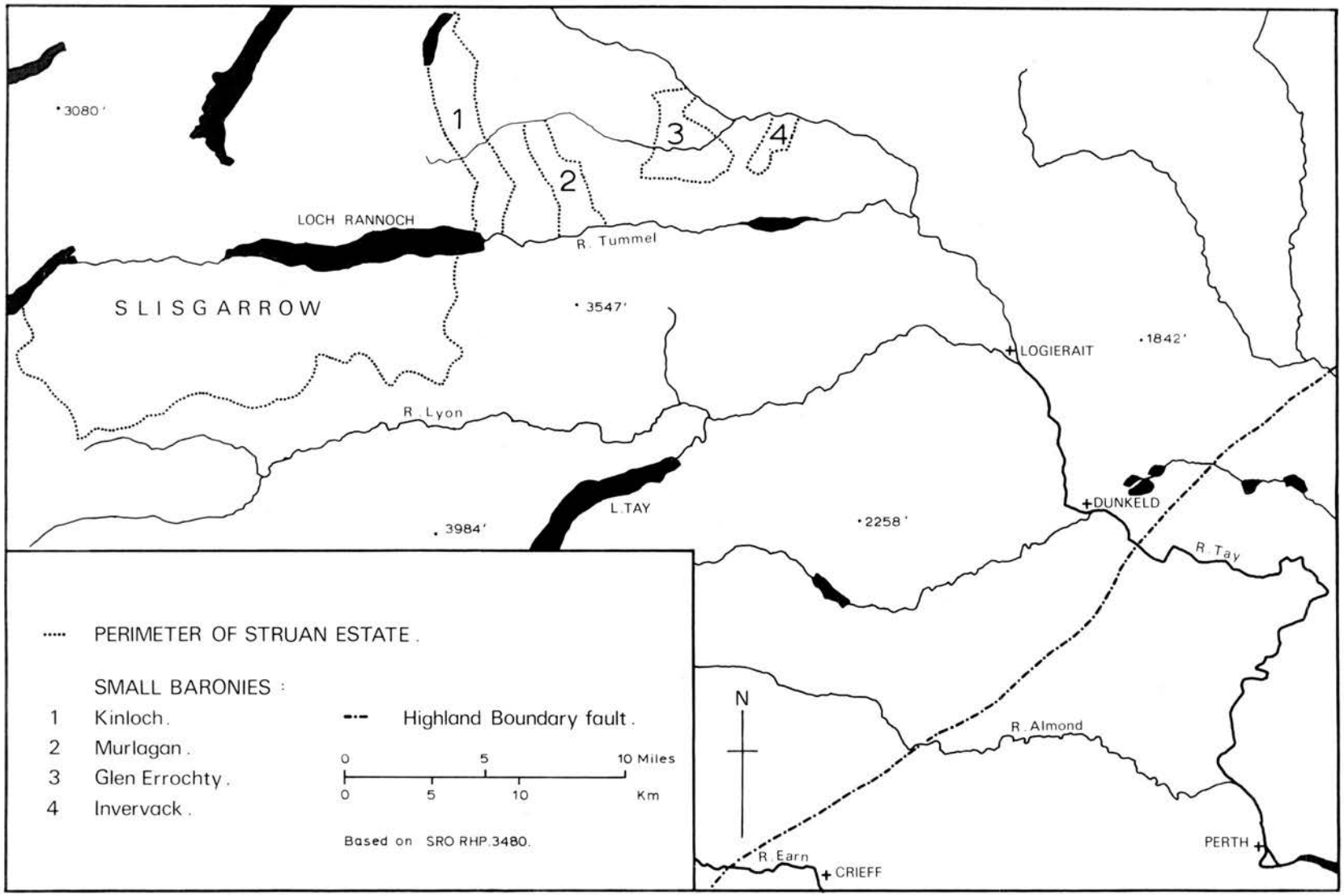


Figure 6.1. Location of the estate of Struan.

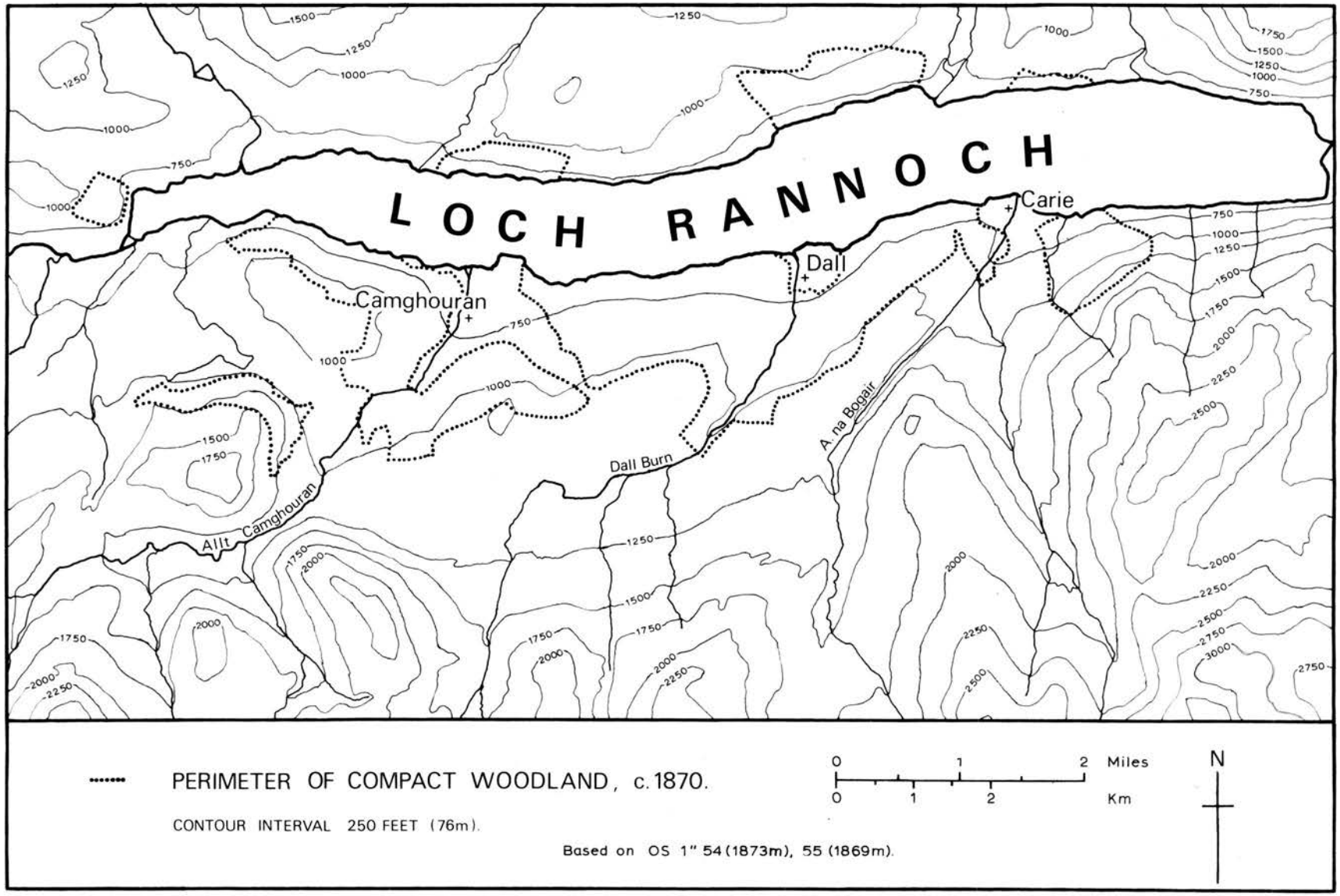


Figure 6.2 . The site of the Wood of Rannoch.

the loch at 675 feet (205 m) to rather more than 1,000 feet (305 m); scattered pines survive as high as 1,400 feet (426 m), but the upper margin of the wood as a whole was approximately equivalent to the line of the 1,100 foot (334 m) contour until additional areas were planted in the late nineteenth and early twentieth centuries (Hunter (1883) 411, Steven & Carlisle (1959) 140, Fig.6.2). In terms of solid geology the site is part of a homogeneous zone of granulitic rocks of the Moine series, from which poor soils are generally derived, but glacial action has modified the surface considerably (Malcolm (1957) 4). The valley was subject to repeated erosion and deposition during the late glacial re-advances and is occupied by glacial deposits which are probably not of immediately local provenance (Sissons (1967) 40-1, 139); the surface consists largely of irregular morainic mounds and marshy hollows (Steven & Carlisle (1959) 141).

Two streams, the Allt Camghouran and Allt na Bogair, are the boundaries of the compact pinewood and a third stream, the Dall Burn, runs through the eastern part (Fig. 6.2). The small alluvial deposits where these streams enter the loch have provided convenient sites for settlement through the historic period; after the late seventeenth century Allt na Bogair and Dall Burn were utilised to power sawmills on the loch shore. The cachment areas of these streams are limited, and in severe winters freezing brought cutting to a halt; the rapid

fall of water level during dry summers made regular operations difficult and put a constraint on the size and form of the sawmills employed (SRO E.783/26/13, 6-7, E.783/50/2, E.783/60/99(1)). In the 1750s it was proposed that Allt na Bogair should be diverted to provide additional power for an enlarged mill at Dall (SRO E.783/98, 25).

The pinewood has a predominantly northerly aspect, and there is no native pine among the deciduous woodland of the south-facing shore of the loch. There is little lithological or edaphic difference between the two sides of the loch, and Malcolm has suggested that the form of insolation is responsible for the distinction; pine is able to compete with deciduous species only in the less favourable conditions of the north-facing slopes (Malcolm (1957) 12). Rannoch receives an annual average rainfall of fifty inches (1,270 mm) and is intermediate between the pinewoods of the west, which generally have annual averages higher than seventy inches (1,777 mm), and those of the east, which receive less than forty inches (1,016 mm). (Steven & Carlisle (1959) 61, 140). The wood is identifiable in character with the western form described earlier (above, 5.3). When Pennant visited it in 1769 he identified heather (Calluna vulgaris), bilberry (Vaccinium myrtilis) and dwarf arbutus (probably cowberry, Vaccinium vitis-idaea) as the plants characteristic of the ground vegetation (Pennant (1771) 87-8); these species continue to dominate much of the drier part of the pine-

wood floor, although the field layer of the denser stands resembles that of the eastern Vaccinium-moss association (Penistan (1942) 64, Steven & Carlisle (1959) 141-2, above, 5.3).

Stand density varies greatly and there is also a range in species composition between pure pinewood and pure birchwood; birch is prominent throughout the wood and other deciduous species are well represented. Rowan is distributed throughout the area of woodland and alder occurs on stream banks and in the wetter sections; aspen, holly, hazel and willow have a more limited distribution (Steven & Carlisle (1959) 141, Hayes (1967) 154). Malcolm found that within any part of the wood species distribution was related to micro-relief, and that pine occupied the drier parts of the mounds; birch grew generally on the lower slopes and in the bases of the better-drained hollows (Malcolm (1957) 9). Age classes are not superficially evident but most of the mature trees belong to broad age categories. Penistan stated that most trees had originated about 1790 or 1880 (Penistan (1942) 64); Malcolm observed in 1957 that the most common period of origin was 1710-1810, and that younger stands dated from the late nineteenth century (Malcolm (1957) 12). Steven and Carlisle found in 1959 that with the exception of a few dating to the period 1710-59 the surviving trees had generally originated between 1760 and 1930; the largest group belonged to the period 1760-1830 but 1860-1930 was

also well represented, partly by trees which had probably been planted in the late nineteenth century (Steven & Carlisle (1959) 142-3).

There is general agreement that many of the remaining trees originated in the late eighteenth and late nineteenth centuries. Selective felling may have reduced the relative importance of the older age classes but is not likely to have depleted the younger groups; at least 200 acres (81 ha) were planted between 1860 and 1880, and plantation may account for a significant proportion of the younger trees (Hunter (1883) 411). There is therefore no conclusive evidence of extensive natural regeneration since about 1830; sporadic regeneration appears to have taken place since then but few trees have established themselves since 1930. The failure of regeneration in Rannoch has been attributed to grazing, especially by deer; the population of deer seems to have increased in the present century and until recently their movements were not restricted (Penistan (1942) 68-9, Whayman (1953) 117). Regeneration is best on sites dominated by heather with a thin layer of mor humus, but seedlings establish themselves in other parts of the wood; in the absence of ground disturbance the initial growth rate of young pines in Rannoch is very slow and they are exceptionally vulnerable to damage by browsing animals (Malcolm (1957) 28-30, Steven & Carlisle (1959) 143-4).

The wood was in the possession of the Robertsons of Struan by the fifteenth century and there is some evidence of the use of Rannoch timber relatively soon afterwards; as already noted, sections were cut for construction around Dunkeld in the early sixteenth century (Steven & Carlisle (1959) 137, above, 5.4). Wood appears to have been made available to the tenants of neighbouring proprietors; in 1631 a tenant on the Glen Orchy lands of Loch Tay was accused of causing the death of a horse while collecting timber in Rannoch (Innes, ed. (1855) 388). Such timber may not have been pine, however, and the casual use of deciduous timber from Rannoch was later permitted (below, 6.3). In 1678 it was noted that during shortages of imported deals the inhabitants of Angus obtained pine timber from sawmills on the west of the Grampians (MacNair, ed. (1883) 21); the sawmills in question were probably those of Rannoch and Glen Lyon.

Alexander Robertson, the twelfth Robertson of Struan, established a sawmill at the mouth of Loch Rannoch a few years before 1675, producing pine deals for local consumption; in that year he petitioned privy council, requesting confirmation of his right to recover floated timber which had been washed ashore on Loch Rannoch or the River Tummel and retained by tenants of other lands. Early in July an order was granted in his favour but it was rescinded at the end of the month, ostensibly because other interested parties had not been consulted and his primary intention

was to cause hardship to the tenants of Atholl and Weem (RPCS Ser.3, V.4 (1911) 421-2, 438). While he was in Edinburgh a large body of men led by the baillie of the regality of Atholl destroyed the dam; Robertson was unable to obtain compensation, as it was found that one end of the dam rested on Atholl land at the discretion of the marquess (RPCS Ser.3, V.4 (1911) 570-6).

In 1683 Robertson applied again and obtained the order which he had originally sought, with supervision of the highways towards Perth from the sawmill, which was now at Carie (RPCS Ser.3, V.8 (1915) 148). He died in 1688, however, and was succeeded by his son Alexander. The thirteenth laird's career was typified by adherence to the Jacobite cause and expenditure beyond his income; the estate was forfeited after the uprisings of 1689 and 1715, and when he returned from exile in 1725 he found it expedient to remain on the estate and avoid his lowland creditors. Involvement in the rebellion of 1745 led to a third forfeiture, but it was not carried out until his death in March 1749, apparently in deference to his age (Allardyce, ed. (1888) V.1, 31-4, Millar, ed. (1909) 265). The estate of Struan then came under the control of the barons of exchequer, but in 1755 administration became the responsibility of the board of commissioners for the management of the thirteen annexed estates.

Governmental administration began effectively with

the appointment of a factor by the barons of exchequer in March 1751 and the first woodkeeper or forester in October of that year (SRO E.700/1, 80, E.783/17/5). The commission managed the wood for almost thirty years until the estate was restored in 1784 to the legal heir, the son of Robertson of Drumachuine (DNB V.48 (1896) 401). The Robertsons remained in possession of the wood until 1857; after a number of changes of ownership the eastern part of the wood was purchased by the Forestry Commission in 1947 (Steven & Carlisle (1959) 140). The Forestry Commission are at present engaged in a programme of conservation and planting with local stock, in association with the Nature Conservancy (Goodlet (1973) 43).

During the administration of the estate by the barons of exchequer and the board of commissioners management was carried out by their appointed factors and foresters in accordance with the policy of the administrative body. The stated aim of the board of commissioners was to civilise and promote the happiness of the inhabitants of the estates, while encouraging the protestant religion, good government, husbandry, industry, manufactures, and loyalty to the crown (SRO. E.726/2, 171). The papers preserved in the Scottish Record Office and relevant to the Wood of Rannoch therefore include a large number of communications between the board and their employees. The main body of papers concerned with the management of Struan estate includes rentals, accounts, contracts, reports and

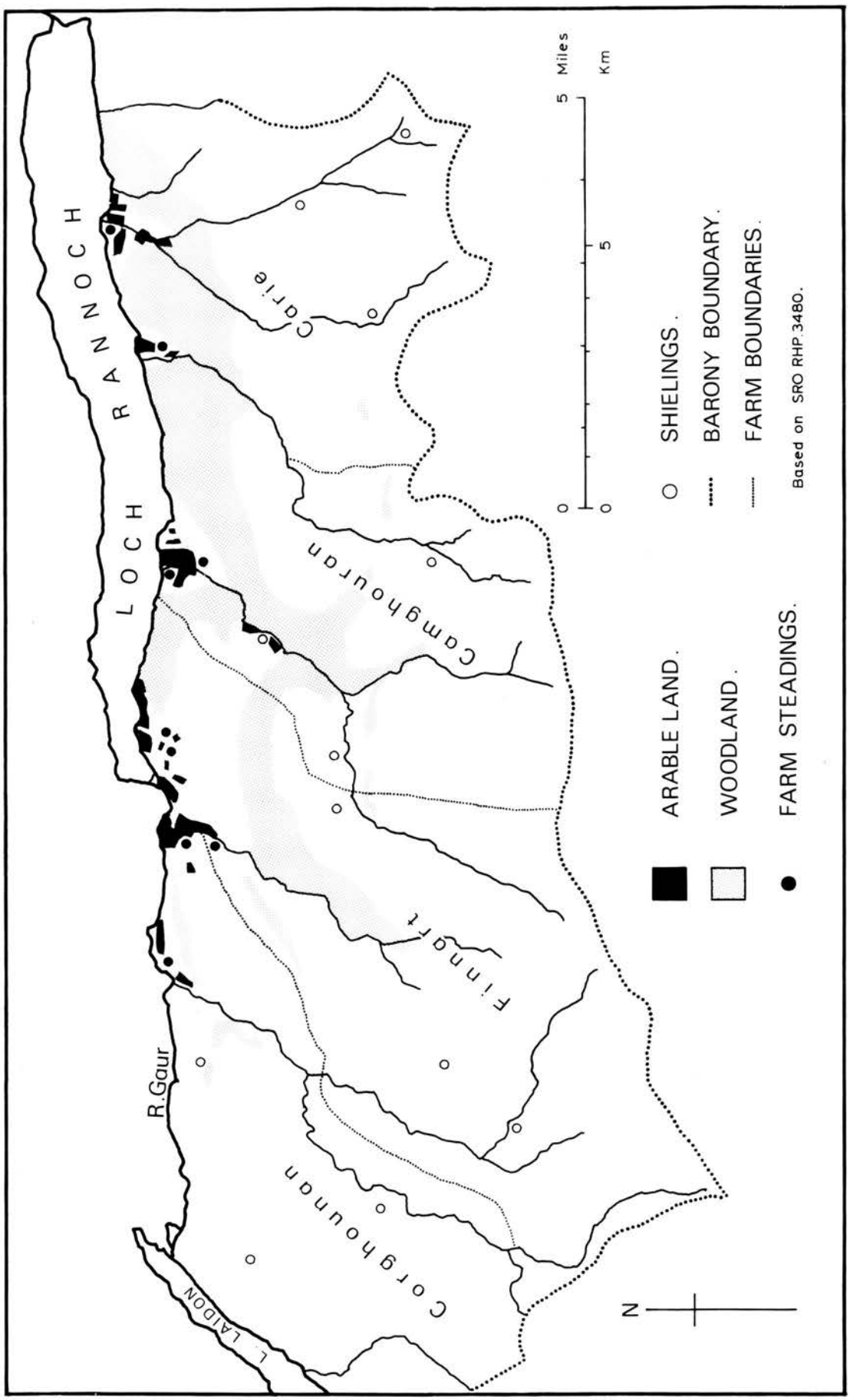


Figure 6.3 . The barony of Slisgarrow , 1756 .

petitions (SRO E.783, E.788). The minute-books and letter-books of the barons of exchequer and the annexed estate commission provide a certain amount of information to supplement the main collection (SRO E.700, E.721, E.726).

6.2 The management of the Wood of Rannoch

The estate of Struan consisted of five baronies in Strath Tummel and Glen Errochty; the detached barony of Fernan on Loch Tay was leased to Lord Glenorchy in 1750 and excambed in 1767 (SRO E.783/25/1, E.783/42/5, Fig.6.1). The five baronies were of negligible agricultural value. A survey carried out in 1756 indicated that infield and outfield together were equivalent to less than two per cent of the total area; eighty-three per cent was described as moor and moss, and woodland covered rather more than fifteen per cent. The barony of Slisgarrow was by far the largest, containing seventy-six per cent of the total area and ninety-five per cent of the woodland, including all the pinewood; almost twenty per cent of the surface of Slisgarrow was covered by woodland and less than one per cent was cultivated (SRO E.783/98, 31, 57, Fig. 6.3). It was recognised that the pinewood was the most valuable resource of the estate as a whole and Slisgarrow in particular (SRO E.783/26/6); immediately after the excambion of Fernan the wood and sawmill accounted for as much as forty-five per cent of the rental value of the whole estate (SRO E.783/42/5, Fig. 6.3).

If it is intended that woodland should provide a sustained yield over an indefinite period it may be cut selectively or by small and regular clear-fellings of parts of the wood; in both cases the rate of extraction must be no greater than the rate of replacement. In the Highlands selective felling was practised in a form which did not approach the quality of true selection or femel forest, and in some cases woods were clear-felled in small annual sections (above, 5.6); the woods of Glen Lyon were cut in annual sections or haggs and became commercially useless when cutting was allowed to exceed the capacity of the wood to replace losses (SRO E.783/14/2). When the wood of Rannoch came under governmental control it had already been cut selectively for some time, and the managing bodies did not introduce radical changes in policy.

The management of woodland to produce a sustained yield requires a coordinated policy in three related fields. The level of extraction must first be confined to a range which will allow the replacement of felled trees by the most appropriate means. If natural regeneration is employed the precise quantity which may be cut annually can be established only with great difficulty after careful measurement over a number of years; the initial estimate should be low enough to allow a considerable safety margin, and the system of cutting should be flexible enough to permit rapid adjustment to changes in

the rate of replacement. Secondly, the trees most suitable for commercial use are generally also the most desirable seed sources, and selective felling of the best timber may in the long term lead to degeneration in the quality of the stand; selective cutting for silvicultural purposes had the objective of improving the quality of woodland, and may therefore make a large amount of poor timber available for sale (Köstler (1956) 212-3). A felling system must therefore permit the cutting of sufficient timber of high quality to make the operation viable, while as far as possible maintaining or improving the stand. Finally, it is necessary to ensure that the felled trees are replaced. If regeneration is abundant it may suffice to prevent the destruction of young growth during cutting; in other circumstances assistance may be necessary to guarantee an adequate rate of replacement.

6.3 Levels of extraction

Alexander Robertson of Struan converted the rents of Camghouran, Carie and Dall into services in cutting timber and delivering it to the sawmill; a guaranteed supply of labour was therefore available for the use of the sawmill and a set quantity of timber was cut for sale each year. The total rent of the farms was £480 Scots (£40 sterling) and six wedders, divided equally between Dall and Carie together and Camghouran. When

converted at a rate of 3/4d Scots (3.3d sterling) per item this was equivalent to 2,880 pieces, of which 1,920 were described as logs and 960 as 'burdens'. The quota delivered by individuals was determined by the sizes of their holdings; the tenants as a group were allowed 144 burdens and forty loads of posts cut from the branchwood, but the rest of the quota was available for commercial sale (SRO E.783/1/10, E.783/1/13).

The meaning of the term 'burden' in this context is not entirely clear, but it did not describe a load or measure, and may have been related to the words 'burdoun' (a staff or stick) and 'burden' (made of boards) (DOST '<u>burdoun</u>', '<u>burden</u>'). The term was used to describe both the unshaped timber and the product of shaping; the sections of timber delivered from the wood were described both as burdens and logs for burdens, and in one case both meanings were used in the same sentence (SRO E.783/1/11). Some accounts stated that the tenants were allowed a load of burdens, rather than a single burden, for each twenty pieces delivered to the sawmill; this suggests that two or more sections were available from each log (SRO E.783/25/2). Prepared burdens may have been thick planks or balks; they were coarse enough to be made with hand tools, although generally produced at the sawmill (SRO E.783/26/2). During sawing rough burdens produced an average of two backs each, in comparison to the four obtained from the squaring of a log for

deals (SRO E.783/26/11); this suggests that each was roughly trimmed and sawn into two or three thick pieces of varying width, although some may have been used whole.

Except in very open woodland the pine of the Highlands commonly has a relatively straight stem, largely free from branches below a crown which may occupy only part of the upper half of the stem (Steven & Carlisle (1959) 240-7, pl.XIIIa). It is possible that burdens were obtained from this upper part of the stem; the sections from which the branches of the crown developed may have been found to contain too many knots for the production of good deals. In calculations of the yield of standing trees no more than one burden was expected from each tree, although as many as four logs might be obtained from tall trees; short mature trees produced one log and one burden (SRO E.783/26/10, E.783/26/11, E.783/26/15). Logs cut for burdens were worth approximately half as much as those cut for deals (SRO E.783/26/4, E.783/26/10). If trees produced an average of two logs for deals and one for burdens, the quantity of timber cut in lieu of rent by the tenants of the farms on the loch indicates the cutting of 960 trees annually.

Cutting under the supervision of the barons of exchequer was delayed until an unauthorised occupier was removed from possession of the sawmill, and the woods were not available for lease until the season beginning at Whitsunday 1751 (below, 6.6). Proposals for a three-

year tack or lease were received by the factor, William Ramsay, who retained the services of the tenants but preferred to reckon the annual quotas in trees rather than logs; he claimed that in the view of well-informed persons the wood could afford 2,500 trees annually (SRO E.783/14/2). This opinion was disputed by Sir Robert Menzies of Menzies, who requested a tack of the woods; Menzies claimed that the wood might be destroyed by regular cutting of quantities greater than 1,000 trees per annum, and that if 2,500 or more were cut annually for three years the wood could yield only 500 trees in each of the following six years (SRO E.783/14/2).

Menzies' offer was refused and Ramsay gave the lease or 'tack' to Alexander Campbell of Corrycharmaig and John Robertson of Tullybelton, then Provost of Perth; no more than 2,000 trees were to be cut annually (SRO E.783/25/2, E.783/26/5). Despite this concession the forester, James Small, submitted a memorandum late in 1751 in which he noted that a sustained yield of 2,000 trees would not be possible; this was followed by a report in which he recommended the cutting of only 1,200 trees per annum (SRO E.783/17/1, E.783/26/7, E.783/26/10). The barons accepted this report; early in December Ramsay was ordered to arrange with the tacksmen that cutting during the season should be reduced to 1,200 trees, with a proportionate reduction in the annual payment (SRO E.783/26/7, E.783/26/10).

The level of cutting was fixed at 1,200 trees for the remainder of the tack but the problem of over-exploitation was not solved. Toward the end of 1752 a group of woodcutters and sawyers in Carie declared that only 1,000 trees should be cut in 1753, and that regular cutting of 1,200 trees per annum could only eventually be possible if cutting was first restricted to an annual quota of 500 trees for seven years (SRO E.783/26/12). There was considerable hostility between Ramsay and Small, who reported to the barons in July 1753 that the degree of damage to the wood in the preceding two years could hardly have been expected in ten (SRO E.788/5/4). Small claimed that Ramsay had concealed certain aspects of the tack from the barons and had taken steps to ensure that Small could not control cutting or investigate the terms on which felling took place. A nephew of Corrycharmaig had been one of Ramsay's original foresters and Corrycharmaig himself had acted as deputy factor while engaged in cutting the woods; Small hinted that Ramsay had shared the profits of cutting (SRO E.783/26/15, E.783/28/1, E.788/5/3).

Small's statements about damage to the wood were not consistent in detail, and seem to have been modified as additional information became available. After submitting his report in July 1753 he examined the tenants of Camghouran and Carie on oath, and it emerged that 1,400 trees

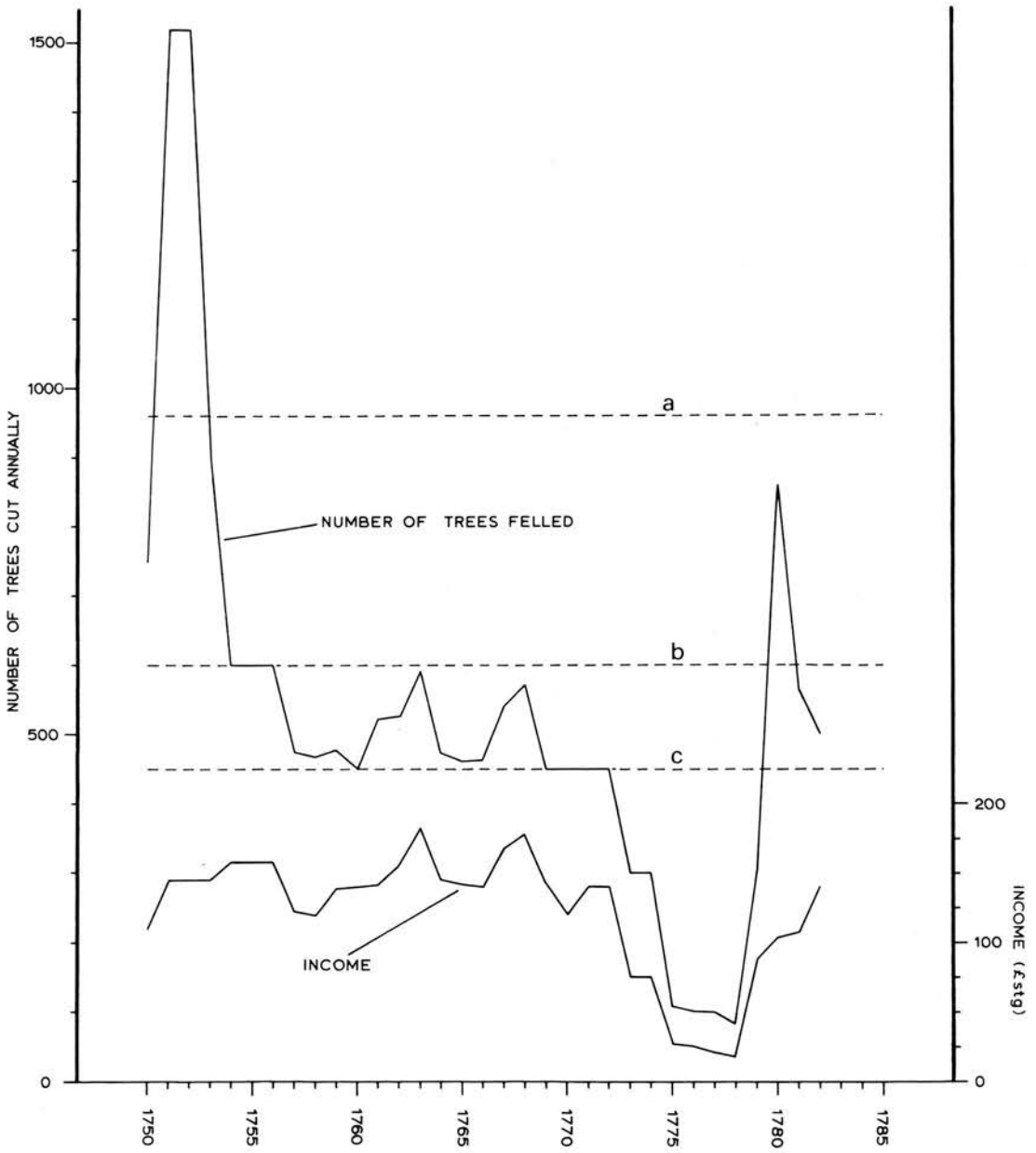
had been cut in each of the first two years; the tenants were able to cut more logs than were required as rent, and the tack permitted payment of an additional sum per log to those who brought more than the required number. In the third year only 800 trees of the overall quota of 3,600 remained to be cut; the tenants were required to deliver in lieu of rent the number of logs generally obtainable from 960 trees, and this could be achieved only by the cutting of exceptionally good specimens. In addition, the burdens given to the tenants had formerly been subtracted from the total annual quota, but Ramsay allowed the tacksmen to buy them from the tenants at a reduced rate, and an additional 120 trees were cut in their place (SRO E.783/26/11).

Evidence and testimonials were submitted to the barons on behalf of both Small and Ramsay (SRO E.783/31/1-3, E.788/2/1-3, E.788/5/1-6). Ramsay resigned his factory at the end of 1753 and Small took his place (SRO E.788/5/1). Having complained about the manifest abuse of the wood during the tack under which the woods were sold by the tree, Small returned to the use of quotas of logs and greatly reduced the annual cutting. From 1754 until the end of governmental control the number of trees cut annually for commercial use did not once reach 960, the number customary during Struan's management. In 1754 Small let the woods for three years with an annual quota consisting of 1,800 logs, of which 1,200 were for deals

and 600 for burdens; it was assumed that 600 trees would on average yield two logs and one burden apiece (SRO E. 783/25/5, E.783/26/16).

When it next became necessary to lease a cutting of the woods the annexed estate commission had taken over the administration of the estate, and the standing committee of the board proposed radical changes early in 1757; services by tenants were to be abolished, the tacksman was obliged to take trees indicated by the forester, and the wood was to be sold by the ton (SRO E.721/2, 30-1). The ton employed consisted of forty cubic feet of round timber (1.1 cu.m), and Small estimated that it was equivalent to three trees of the size commonly cut in Rannoch (SRO E.783/76/2); this relationship appears to have remained constant, as three trees were on average equal to 0.95 tons during the period 1775-8, when both measures were employed (E.783/103/22, E.783/105/2). Together with George Sandeman, a joiner from Perth, Small submitted a report in May 1757 recommending that 600 trees could be cut per annum (SRO E.783/76/2). When a new tack was issued with effect from Whitsunday 1757 the tacksman was allowed to cut between 150 and 200 tons of timber annually, which by Small's estimate represented the range between 450 and 600 trees (SRO E.783/85/1).

The sequence of annual cuttings between 1750 and 1782 is illustrated by Figure 6.4, representing the total known to have been felled for commercial use in each year,



THE ANNUAL LEVEL OF FELLING IS STANDARDISED IN TERMS OF TREES, IN ACCORDANCE WITH THE RELATIONSHIPS BETWEEN THE MEASURES 'LOG', 'TREE', AND 'TON' AS EMPLOYED IN RANNOCH (See text, section 6.3).

INCOME REPRESENTS THE TACK DUTY PAID ANNUALLY TO THE ESTATE FOR THE WOODS AND SAWMILL, BEFORE DEDUCTION OF RECURRENT COSTS (See text, section 6.6).

a — ANNUAL LEVEL OF FELLING BEFORE 1750.

b,c — UPPER AND LOWER LIMITS RESPECTIVELY OF THE RANGE OF FELLING LEVELS PERMITTED AFTER 1757.

Based on SRO E.783/102, E.783/103/1-22, E.783/105/1-6.

Figure 6.4. Annual fellings and income from the Wood of Rannoch, 1750-82.

together with small quantities given by the factor without charge at the direction of the board. In the period 1750-76 each value represents the quantity cut in the twelve months after Whitsunday in the stated year; when annual roups were introduced the sale was held in September but the wood was cut and paid for in the following year. The first roup, held in September 1778, was therefore included in the accounts for 1779; the roup dates included in Figure 6.4 and elsewhere are those attached to the appropriate accounts. In the 1777 season the tacksman was given permission to cut two quotas; the second, cut early in 1778, has been taken to represent the 1778 season (SRO E.721/27, 43). It will be seen that the quantity cut annually fell greatly after 1753 and remained until 1772 within the range defined in 1757. There was then a marked decline, but the cutting level rose again when roups were introduced, and in 1780 the cutting exceeded 600 trees for the first time since 1753 (Fig. 6.4).

The quota of standing timber was at times supplemented by wood described as lying or fallen timber, terms which appear to have been interchangeable in practical use (SRO E.783/26/16, E.783/25/5). 'Underground timber' was also available; in 1758 Small defined this as the wood which had some years previously been injudiciously felled or blown down and had since sunk into the ground (SRO E.783/60/7(1)); fallen or lying timber presumably originated in the same way and became underground timber

unless removed from the wood. A certain amount of wastage arose from windthrow; in December 1778 more than one thousand trees were blown down, and a smaller amount of storm damage was recorded in the winters of 1756-7 and 1783-4 (SRO E.783/76/2, E.783/76/10, E.783/60/298(2)). Much of the fallen timber was probably the residue of felling; Small claimed that Struan had persistently cut more than he required, and in 1757 he noted that the tacksmen had always rejected parts of the cut timber, including sections as much as eight feet (2.4 m) in length and all the branchwood (SRO E.783/76/2, E.783/84/1).

The accumulation of fallen timber impeded drainage in the wood and made access to some parts difficult (SRO E.783/76/2); commercial use of it provided a small profit and assisted in the clearance of the site. The tack of 1751 allowed the tacksmen to use sufficient fallen timber to raise the overall annual total to 3,500 logs, and the tack of 1754 permitted the use of 200 logs of fallen timber per annum, or two burdens in place of each (SRO E.783/25/2, E.783/25/5). The timber was acceptable after squaring, although it was necessary to discard the outer sections; payment for fallen timber in period 1754-6 was equivalent to 2/0d per log and the average value of logs of standing timber was only 4d more (SRO E.783/25/5). In the three years after 1757 the tacksman was required to take large and small lying timber as directed by the forester in addition to the quota of standing timber, but

it is not clear whether this was given without charge or purchased at the standard rate per ton (SRO E.783/85/1). This stipulation may have been included in a series of similar tacks extending to 1774, copies of which are no longer available.

Fallen timber was also a convenient source of wood for distribution without charge. In 1754 fallen timber was provided for the building of a storehouse on Loch Rannoch and in 1756 it was given to the troops at Invercomrie for use as palings (SRO E.721/1, 82, E.783/17/2). At that time part of Slisgarrow lay in Logierait parish, and in 1756 the heritors requested timber from 'the old lying decayed trees' in Rannoch for the construction of a manse; the factor was ordered to supply fallen timber equivalent to the estate's share of the costs, but any additional requirements were to be met by the sale of timber from the sawmill (SRO E.721/1, 83, 88). There is little evidence of the regular employment of fallen timber in the later part of the period; it is possible that the supply of old fallen timber suitable for use was exhausted, and that the stricter controls imposed on cutting reduced the quantity of waste.

A certain amount of standing pine was cut and retained for the use of the estate. While Ramsay was factor his house was renovated and timber was also given to the tenants for construction of timber bridges (SRO E.783/26/11, E.788/5/3). When the sawmill at Dall was rebuilt in

1758-9 Rannoch pine was used for walls and roofing, and more was used in 1761 to renovate the factor's house and build a courthouse at Carie (SRO E.721/4, 207, E.783/50/2, E.783/103/8). The factor met the costs of timber for the repair of mills on the estate, but the millers paid for sawing and carriage (SRO E.721/4, 201, E.783/60/13). Timber was also given for the benefit of the local community. Wood was supplied for a ferry at Kinloch Rannoch in 1758 and for the rebuilding of the public house there in 1760 (SRO E.721/4, 98, E.783/103/6); in 1761 pine was made available for the renovation of the public house at Dalnacardoch on the Garry and in 1779 timber was allocated for the building of a place of worship in Glen Lyon (SRO E.783/102 (1781), E.783/103/8-9).

As already noted, Struan allowed the tenants of Carie and Camghouran loads of burdens from the sawmill and posts from the branchwood or crops. It is not clear how the rest of the inferior cut timber was used, but in 1759 a tenant in Camghouran, asking the commissioners for pine timber to rebuild his house, stated that this would be supplemented by the pieces which he could pick from the lying timber in the wood (SRO E.783/60/26); the residue of poor timber may therefore have been left for casual collection and use. In 1758 the tacksman of the wood, who was by then required to pay the tenants to cut and carry timber, obtained permission to grant them the crops and underground timber as a means of reducing his cash outlay (SRO E.721/4, 87, E.783/60/7(1).). When tenants

required manufactured pine timber, however, they were expected to buy it from the sawmill, and only in a few exceptional cases was a supply of house timber granted to those who petitioned the commissioners (SRO E.721/4, 198, 221, E.783/60/18, E.783/60/26).

It has already been noted that the tenants of neighbouring estates made use of Rannoch timber in the seventeenth century (above, 6.1); Alexander Robertson of Struan permitted cutting of this kind, accepting payment in kind only for large quantities (SRO E.783/26/11). In 1751 Small found that many of the large trees had been damaged by the cutting of candle fir; he consequently dismissed the claim of a servitude over deciduous timber and candle fir made by the duke of Atholl's tenants of Bunrannoch, although Ramsay had permitted the tenants of Menzies of Menzies on the north shore of the loch to continue such cutting (SRO E.783/17/1, E.783/26/11). The total quantity of timber cut for non-commercial purposes was almost certainly small in most years; in cases where the quantity cut during a year can be established it has been added to the total quantity of timber cut for sale as shown in Figure 6.4, and in no case is it a significant part of the overall total (Fig. 6.4).

The inhabitants of Rannoch were not conspicuously honest, and a certain amount may have been removed by theft. In 1751 Small complained that the wood was too large and sprawling to be supervised by a single person and that

it was persistently damaged by the local people; it was necessary to pay for information and send reliable men to the markets where stolen timber was sold. Timber was stolen by those sent to cut it and the employment of systems of marking and numbering could not eliminate abuse by the woodcutters and tacksmen (SRO E.783/26/15, E.783/76/2). Small found himself mistaken in his belief that the abolition of services in 1757 would lead to the introduction of an honest full-time workforce (SRO E.783/60/45). Even when the identity of the thieves was known punishment was not easy; when a large group of cottars and tenants, who begged in other districts in summer and stole timber for sale and fuel in winter, appeared before the baron court in 1753, the fines imposed on them were made meaningless by their poverty (SRO E.783/26/11). The estate officers could do little to control persistent offenders; thus in 1762 a man officially banished from the barony for stealing wood in 1753 continued to live illegally and openly on a holding in Carie (SRO E.783/60/54). In 1763, however, the commissioners sent a body of soldiers under a sergeant to prevent theft and maintain order under the factor's control (SRO E.726/2, 43-4).

6.4 Felling systems and the replacement of losses

The second major aspect of the management of the pinewood was the system of felling employed. It is evident that Struan permitted the completion of the annual quotas

of logs by selective cutting, and this continued under governmental administration (SRO E.783/84/1). The results of prolonged selective felling were evident in June 1751, when the new tacksmen had the wood examined and found less than 1,000 trees capable of producing three logs for deals, mainly in the more remote parts of the wood (SRO E.783/26/10). The tack of 1751 itself emphasised the dangers of such a cutting system; definition of the quota in trees rather than logs encouraged the tacksmen and the woodcutters, who paid their rent in logs, to select the trees which would yield the greatest quantity of timber. Damage was evident before the tack was complete; in 1752 a group of woodmen in Carie deponed, perhaps at Small's instigation, that few trees survived of a quality comparable to those cut in the preceding two years (SRO E.783/26/12).

Small himself complained in 1753 that the tack had given him no power as woodkeeper to prevent the cutting of the biggest and best trees; he pointed out to the barons of exchequer that the wood contained many old trees shorter than those cut by the previous tacksmen and no greater in diameter; these had stopped growing and were in some cases decaying, but no tacksman would cut them if younger and better trees were available (SRO E.783/26/15). He advocated a return to quotas of logs, which would reduce prejudice against small trees, but recognised that an element of direction by the forester was necessary to prevent

abuse. The aim of control was to encourage selection on silvicultural as well as commercial grounds; his initial proposal in 1751 was that the tacksmen should be compelled to cut trees from sections of the wood where the young stand was dense enough to benefit from thinning, and when the next lease was due he proposed that the tacksmen should be required to cut the old trees before they became useless (SRO E.783/17/1, E.783/26/15).

Small also submitted an estimate of the value of 600 trees taken as they stood irrespective of quality; this suggests an approach to clear-felling, but the tack which followed included no restriction on felling except that the tacksmen and forester should exercise joint control over cutting and carriage by the tenants (SRO E.783/25/5, E.783/76/1). Early in 1757 the standing committee of the board of commissioners decided to change the system. Discriminative felling was to be eliminated by the employment of a standard ton rather than the previous variable measures; the tacksman was to be compelled to take only the older trees and any others indicated by the forester (SRO E.721/2, 30). A joint report by Small and George Sandeman followed this; they recommended that the wood should be clear-felled in distinct annual sections, although the clearing of scattered trees and areas already severely depleted by selection would be advisable before hagg cutting was introduced (SRO E.783/76/2).

The joint report therefore differed to some extent from the findings of the standing committee, which were accepted with minor modifications (SRO E.721/2, 115). The three-year tack signed in that year followed the principles recommended by the committee and did not specify the type of timber which should be cut, although the tacksman was obliged to follow the directions of the forester (SRO E.783/85/1). Copies of the later tacks have not survived, but it seems probable that selective felling continued, supervised to some extent by the forester; each year the forester and tacksman together declared the quantity of timber cut for sale and other uses (SRO E.783/103/4-22).

There is little information about the form of cutting after 1760, but interest was renewed after 1775. In 1777 George Nicolson, a nurseryman in Callander employed by the commissioners to advise and report on matters relating to woods, examined the wood of Rannoch; he suggested that each cutting should include all the timber fit for sale in a given part of the wood, although his stated aim in proposing this was to discourage malpractice on the part of the forester (SRO E.783/76/5). In the following year Nicolson submitted another report proposing that selective felling should be totally abandoned; cutting was to begin at the east end of the wood and proceed westward, sparing only trees which had not reached maturity (SRO E.788/22/2). After considering a number of reports, however, the board

decided to continue selective felling, maintaining sale by cutting mature trees and those which showed signs of decay (SRO E.721/27, 52, E.783/76/9).

It is therefore apparent that selective felling was employed throughout the period of governental control; selection was based on silvicultural and commercial criteria after the initial tack. The failure to establish hagg cutting may be attributed in part to the irregularity of the terrain and the very varied quality of the wood; the cuttings of individual years could not initially be equal in size, quality and accessibility. The cutting of a hagg of pine did not guarantee uniform regeneration on the site; in contrast to coppice there was no predictable relationship between the quantity of timber cut and the degree of regeneration. Finally, even if hagg cutting could be adopted successfully in such conditions it could only be achieved at the expense of regular profit in the short term; in some years it would be necessary to cut exceptionally poor and remote sections. As shall be seen later the sale of the produce of Rannoch was difficult even in favourable conditions (below, 6.6).

It has already been noted that an annual cutting of 600 trees or 200 tons was chosen in 1757, but Figure 6.4 indicates a sharp decline in the quantity felled after 1772 (Fig. 6.4); this might be taken to indicate adjustment to an evident difference between the cutting rate and the rate of replacement. There is no evidence,

however, that the capacity of the wood for sustained production decreased over the period. In 1778 the head forester stated that it could afford at least 100 tons per annum without real damage, and suggested that as many as 500 trees should be marked for sale each year (SRO E. 783/76/6). In the same year the new factor, Robert Menzies, proposed that between 100 and 300 tons of timber should be cut annually (SRO E.783/76/7); in 1782 he considered that the 500 trees cut in that year represented the approximate annual capacity of the wood (SRO E.788/16/2). George Nicolson was more sanguine, and claimed in 1778 that the wood could yield 1,000 trees every year during the following century (SRO E.788/22/2). Even the lowest of these estimates indicated a minimum yield of 300 trees, and reduction in cutting between 1772 and 1780 cannot be explained by a major fall in productive capacity; as shall be seen later, marketing difficulties were largely responsible (below, 6.6).

The continued productivity of the wood over a period of more than thirty years indicates that losses were entirely or largely replaced by natural regeneration or planting; there is some evidence of spontaneous regeneration. Small noted free growth of young trees on the upper margins of the wood, and in 1751 he described thickets of young trees which indicate mass regeneration; Ramsay's claim in the same year that a hundred young trees sprang up for each one cut, although undoubtedly an exaggeration, indicates con-

tinued regeneration (SRO E.783/14/2, E.783/17/1, E.783/84/1). Confidence in natural regeneration was not complete, however, and throughout the period there were attempts to assist regeneration and plant timber. James Small remained in office as factor between 1754 and his death toward the end of 1777, when he was replaced by Robert Menzies (SRO E.721/27, 41-2, E.783/72/5); his policy in this field is therefore likely to have had a considerable effect on regeneration in the wood.

Small thought that protection by heather was essential to the survival of pine seedlings, and that the growth of birch, alder and other deciduous species was the principal obstacle to the establishment of young pines (SRO E.783/17/1). He attributed the prevalence of birch and alder to selective felling, which permitted the colonisation of gaps left by the felling of single pines; pine seedlings and the heather necessary to shelter them were shaded out (SRO E.783/84/1). Young trees were damaged by the cutting of older trees among them, and the accumulation of waste timber in the wood obstructed drainage, creating marshy conditions unsuitable for regeneration (SRO E.783/76/2). Small's objective was therefore the creation of open environments clear of surface obstructions, in which heather and pine could grow without difficulty. This could be achieved partly by regularisation of cutting; the joint report by Small and Sandeman in 1757 suggested that areas of the wood already opened by selective felling should be cleared, and that the refuse

could be gathered and burned. When hagg cutting was introduced the tacksmen were to take all the useful timber and the refuse was to be piled on the perimeter of the hagg, where it would serve as a fence (SRO E.783/76/2); the tack of 1757 permitted the forester to direct the removal of refuse to the perimeter (SRO E.783/85/1).

The most important part of Small's policy, however, was the elimination of birch and alder. In his preliminary report of 1751 he treated the destruction of these trees as a matter of urgency; if they could not be sold they were to be burned as firewood or given to anyone who would take the timber away (SRO E.783/17/1). In 1755 Small again emphasised the harmful qualities of these trees, and requested authority to have them cleared (SRO E.783/84/1). The limited commercial value of such timber in the district made profitable disposal difficult, and Small's initial interest in coaling them for iron smelting was later abandoned (SRO E.783/17/1). In 1763, however, he began to produce potash at the west end of the wood with the assistance of the garrison at Invercomrie; other vegetation was more suitable in the long term but he was able to burn a certain amount of birch and alder. Despite Small's hopes, the enterprise did not attract commercial interest, although some potash was still produced with birch timber when Pennant visited the wood in 1769 (SRO E.783/84/14, Pennant (1771) 88n).

In some cases timber seems simply to have been cut

and destroyed. A memorandum of 1762 stated that the pine wood could be saved only by the cutting of all the birch and alder among the young pines, and the commissioners gave authority for this (SRO E.721/6, 175-6). Small seems to have anticipated the granting of permission, however, as the accounts for 1761 include payment to the deputy forester for the cutting of birch and other barren timber in the wood (SRO E.783/102 (1761). The most effective means of removing barren timber was to permit the tenants of the barony free access to it, which had the additional advantage of reducing the danger to the pinewood. Small appears to have imposed no restriction on the use of barren timber, and the effects of this were evident in 1779, when Robert Menzies found that the birch woods were badly damaged and full of cut timber; he found it necessary to prohibit the cutting of timber except under the supervision of one of the estate officers (SRO E.783/60/230).

Small had some success in assisting regeneration. In 1763 the troops cleared birch and alder from a section of the wood more than a mile long for the production of potash and it was then enclosed; Small reported the growth of a fine crop of young pines (SRO E.783/84/14). Although the boundaries can no longer be traced, the enclosure was in the western part of the wood; grazing animals were still excluded in 1780, when the tenants of Easter Camghouran requested grazing in the enclosed area, which they

claimed was a mile square (259 ha) and no longer likely to be damaged by grazing (SRO E.783/60/253). Small also considered planting; in his general report of 1755 he observed that the lower parts of the wood contained only scattered pines and requested permission to plant seedlings or distribute seed in a belt along the side of the loch (SRO E.783/84/1). There is no evidence that authority for this was granted.

Interest in regeneration did not decline after Small's death in 1777, but emphasis moved from the suppression of barren timber to protection of young trees against grazing damage. In February 1778 John Cameron, the head forester of the time, suggested that regeneration could easily and rapidly be obtained by the enclosure of certain parts with birch timber or pine branchwood (SRO E.783/76/6). In the following month George Clerk-Maxwell, to whom had been remitted examination of reports on the wood, proposed that it should be surveyed with the aim of enclosing it totally with a stone wall or turf and paling dyke; he also recommended that vacancies in the wood should be filled by the use of seedlings or seed (SRO E.721/27, 44, E.783/76/9). By the end of the year George Nicolson had examined the wood and prepared an estimate. He calculated that a wall four feet (1.2m) high with an outer ditch would cost at least £700; this could be justified only by an increase in the annual income from the wood of at least £40, and additional outlay would be required for

abatement and maintenance (SRO E.788/22/2).

In Nicolson's view permanent enclosure was unnecessary, and the wood in its natural state was capable of yielding the established annual quota for an indefinite period; his main recommendation was that clear-felling should be introduced, and that the clearing should be enclosed for eight or ten years with the refuse of cutting (SRO E.788/22/2). Clerk-Maxwell disagreed, however, and presented his own proposals to the board. He favoured enclosure of the 1,900 acres (770 ha) of the Black Wood, leaving an additional thousand acres (405 ha) of scattered fragments to be enclosed later if necessary; it was most important that there should be an adequate wall where Easter Camghouran adjoined the wood, and the rest of the wood could be enclosed relatively cheaply with a small fence sufficient to exclude some of the animals. The foresters were to prevent grazing in the wood and especial care was to be taken to exclude goats; vacancies were to be filled with young trees transplanted from the denser stands, or sown with seed from the best mature trees (SRO E.783/76/9). The commissioners approved this plan, including the suggestion of a small fence, in February 1779, and the factor was ordered to execute it (SRO E.721/27, 52).

As already noted, none of the tenants had written authority to use the grazing of the wood, but those of

Easter Camghouran were unwilling to lose their customary pasture; their animals were eventually excluded from the wood without the necessity of abatement (above, 4.5). By the end of 1780 the fence was complete at Easter Camghouran. The factor observed that a small fence would offer little protection to the rest of the wood during winter, when it was endangered by large numbers of unhoused animals; sufficient loose stone was present along the proposed line of the fence to permit cheap construction of a stone dyke (SRO E.783/76/11). Clerk-Maxwell agreed and suggested that enclosure with stone could be completed for £500, but the reaction of the board to this proposal is not certain (SRO E.721/27, 63, E.783/76/13). By the end of 1782 the wood had been enclosed on the south and west sides for less than £300, and enclosure of the Black Wood was complete by December 1783 (SRO E.788/16/1, E.788/22/2).

A hundred acres (41 ha) of open ground were enclosed on the south side of the wood, and in 1782 George Nicolson recommended that they should be planted by the sowing of seed under the existing ground vegetation, although spontaneous regeneration occurred on the margins of the established wood (SRO E.788/16/1); in December 1782 the board approved this proposal and ordered the factor to fill gaps in the wood (SRO E.721/27, 69). Planting does not seem to have been totally successful; a year later Nicolson asked permission to have deep heather and grass on the

open ground cleared before the sowing of seed; his additional suggestion that the grazing of pigs would serve to break the ground surface preparatory to the planting of vacancies did not meet with the approval of the board (SRO E.721/27, 75, E.788/22/4). Although Nicolson had ambitious plans for the restocking of the wood, they were almost certainly halted by the restoration of the estate to the heir in 1784, and it is not clear how much planting was in fact undertaken after the enclosure of the wood.

6.5 Preparation and distribution of the produce

The sale of timber from Rannoch was hampered by the inaccessibility of the site. Unless cutting took place in the immediate vicinity of the sawmills it was necessary to cut and trim the trees, take the logs to the loch shore, and float them to the shore near the sawmill. The nearest major burgh was Perth, rather more than forty miles (65 km) distant by road, and the markets for sawn timber were necessarily more local. The nature of the site added to the difficulties of access. Small noted in his report of 1755 that the wood was full of hills, bogs and rocks, and one tacksman later complained about the difficulty of transporting timber through the wood (SRO E.783/26/15, E.783/60/7(1)). Most of the pine timber was some distance away from the loch and many of the best trees were especially remote, perhaps as the result of prolonged selective felling (SRO E.783/26/10, E.783/60/7(1)).

It has already been noted that the tenants of the farms near the wood were required to cut and carry timber in place of rent; they were also obliged to maintain the sawmills (SRO E.783/25/2, above, 6.3). The cutting season began at Whitsunday in mid-May and the timber was delivered to the mill by Martinmas in November (SRO E.783/26/13, 78). Logs were probably dragged to the shore by horses after brief seasoning, and they were then towed in groups or 'flotts' by boats to the shore at the sawmill (SRO E.783/14/2, E.783/26/2). Each log delivered at the shore represented 3/4d Scots (3.3d sterling) in rent. The tacksman was responsible for the transport of logs from the shore to the sawmill; in 1752 this was estimated to cost an additional 0.7d sterling per log, making the total cost of delivery to the sawmill 4d per log (SRO E.783/1/13, E.783/26/10).

Cutting and carriage by the tenants of Carie and Camghouran continued until 1757. In that year it was decided that services should be converted to money rent; the tacksman was therefore compelled to have delivery carried out at his own expense, and was given a larger farm in Dall than previously, to accommodate the labourers and horses required (SRO E.721/2, 31, E.783/85/1). In practice, however, the tacksmen continued to employ the tenants, paying sums equivalent to the former rental values of logs; in 1758 the tacksman was also granted permission to give them inferior timber to replace the burdens formerly allocated

to the tenants (SRO E.721/4, 87). In 1762, however, the tacksman submitted a petition in which he asked for the restoration of services and offered to pay the money rent of the farms himself; he claimed that the tenants had begun to call for payment far greater than formerly customary (SRO E.783/60/45).

Small acknowledged that the tenants of Carie and Camghouran were the only resident source of labour, and that the farm in Dall was too small to support the labour force required by the tacksman; he therefore supported the petition and the board ordered the return of services in March 1762 (SRO E.721/6, 164-5, E.783/60/45). The tenants appear to have remained uncooperative and when the same tacksman petitioned for a new lease in 1767 he asked for an order compelling them to cut and carry timber for 4d sterling per log, or land sufficient to accommodate labourers (SRO E.721/10, 116, E.783/60/155). Formal services appear to have lapsed again when the new tack commenced or soon afterwards; in 1778 the forester observed that the tenants had until some time previously cut and carried timber for 4d per log, with perquisites which raised the value of payment to 5d (SRO E.783/76/6).

It has already been noted that there was a sawmill at Carie by 1683 (above, 6.1); when the estate was forfeited in 1749 there were mills both at Carie and at Dall. Both were old and inefficient, as is indicated by the report by Small and Sandeman in 1757. The blades were

thick and wasted a considerable amount of timber, and the slow operating speed produced deals with a rough surface; the frames were so irregular that deals were grossly uneven in thickness, and it was estimated that losses were equivalent to one deal in seven. It was recommended that the Dall mill alone should be rebuilt with a better mechanism permitting production of sawn timber in a variety of dimensions (SRO E.783/76/2). Before the report had been considered the mill at Dall was burned down, allegedly by a tenant who resented removal from a holding there; the board therefore decided in August 1757 to have it rebuilt, retaining the Carie mill until this was done (SRO E.721/2, 82, 115, E.783/60/65(3)).

Sandeman claimed that Rannoch deals were generally disliked as being rough and uneven. He himself was unwilling to use local timber for purposes requiring knot-free and well seasoned wood without a tendency to warp; Rannoch timber was therefore used only for the roof, walls and flooring of the mill (SRO E.783/50/2). Construction began in the first half of 1758 and the mill was almost complete in February 1759 (SRO E.721/4, 97-8, E.783/60/17); Sandeman's initial estimate of the cost as £195 proved inaccurate, and the final cost was more than £350 (SRO E.721/4, 207-8, E.783/50/2). The new mill required skilled operation, and it was decided that the estate and tacksman should jointly pay a trained sawmiller

(SRO E.721/4, 190, 225, E.783/50/1).

The new mill was not totally successful. Sandeman installed a large waterwheel designed to be less sensitive than its predecessors to reductions in water level, but summer drought continued to stop work, and in 1764 the tacksman asked the board to provide money for the construction of a reservoir (SRO E.783/50/2, E.783/60/99(1-2)). Work was stopped for six months after July 1769, when the waterwheels failed, and the roof appears to have offered little protection; in March 1771 the factor obtained authority to have a slate roof installed but in August of that year the roof, joists, flooring and part of the machinery were simultaneously affected by rot; work halted for another six months and the tacksman was forced to use handsaws to complete orders (SRO E.721/27, 18, E.783/60/196-7). More than £240 was spent on repairs to the mill between 1768 and 1774, and it was again under repair in 1776 (SRO E.783/76/4).

The produce of the Wood of Rannoch was not easily marketed; when the wood came under governmental administration only two roads linked north Perthshire with the southern markets, and neither passed through Rannoch. The closer was the military road to Crieff, passing within six miles (9.7 km) of the east end of the loch; this road joined the road from Strathspey to Perth at Dalnacardoch, eight miles (12.9 km) northeast of Kinloch Rannoch, but there were no surfaced roads on the more

direct routes to Perth (BM(M) K.Top. 50 . 69). James Small attempted to improve access to the sawmill, and in 1756 obtained an order for the construction of a highway through the district, running westward from the military road; by July 1758 this road extended almost to the west end of the loch (SRO E.721/1, 135, E.721/4, 177). When governmental control ended communication was considerably easier, but the wood remained remote from major markets (Stobie (1783m)). The market provided by the population of north Perthshire was limited; most of the area within a radius of ten miles (16 km) was uninhabited upland, and the unpopulated expanse of Rannoch Moor began immediately beyond the west end of the loch.

The use of carriages provided one means of selling timber outside the district. Tenants in the farms of Slisgarrow west of the wood and other baronies in Struan were required to perform long carriages of deals or burdens from the sawmills in proportion to the size of their holdings; the Slisgarrow tenants carried timber to Crieff and Perth, but the others apparently served Perth alone (SRO E.783/1/1, E.783/1/6, E.783/1/9). In 1755 a total of eighty-five carriages were provided, equal numbers coming from the baronies of Slisgarrow and Invervack (SRO E.783/43). One partner in the tack of 1751 was John Robertson of Tullybelton, a merchant who was then Provost of Perth (SRO E.783/26/5); carriages may have allowed him to dispose of a certain amount of timber in lowland Perthshire.

When Small commented on carriages in his report of 1755, however, he noted that they were valuable primarily in allowing provisions to be brought into the district (SRO E.783/84/1). The order of 1757 which converted services to the mill into money rents abolished services to the sawmill in general, and there is no mention of carriages of pine timber after that date (SRO E.721/2, 31).

It is evident that the tacksmen relied largely on local demand. In 1762 the tacksman of the time requested a new lease; he had previously been required to cut at least 150 tons of timber per annum, and he wished to have a smaller quota. The level of demand depended largely on the varying requirements of the gentlemen of the surrounding districts, and he foresaw that if he were compelled to fell the established quota it would be necessary in some years to sell much of the timber in the low country for a marginal profit (SRO E.783/60/61(1)). His tack was renewed without a reduction in the quota, and five years later he submitted another petition. The market had been poor in the previous two years, and there were no customers for the 200 tons of marketable timber in stock in March 1767; there had been little demand from the earl of Breadalbane and little had been sold to the duke of Atholl, formerly another major customer, since the pinewoods of Braemar had been made more accessible to Atholl by a new road (SRO E.783/60/155).

During the period when the wood was leased to tacksmen the estate kept no record of the destination of timber;

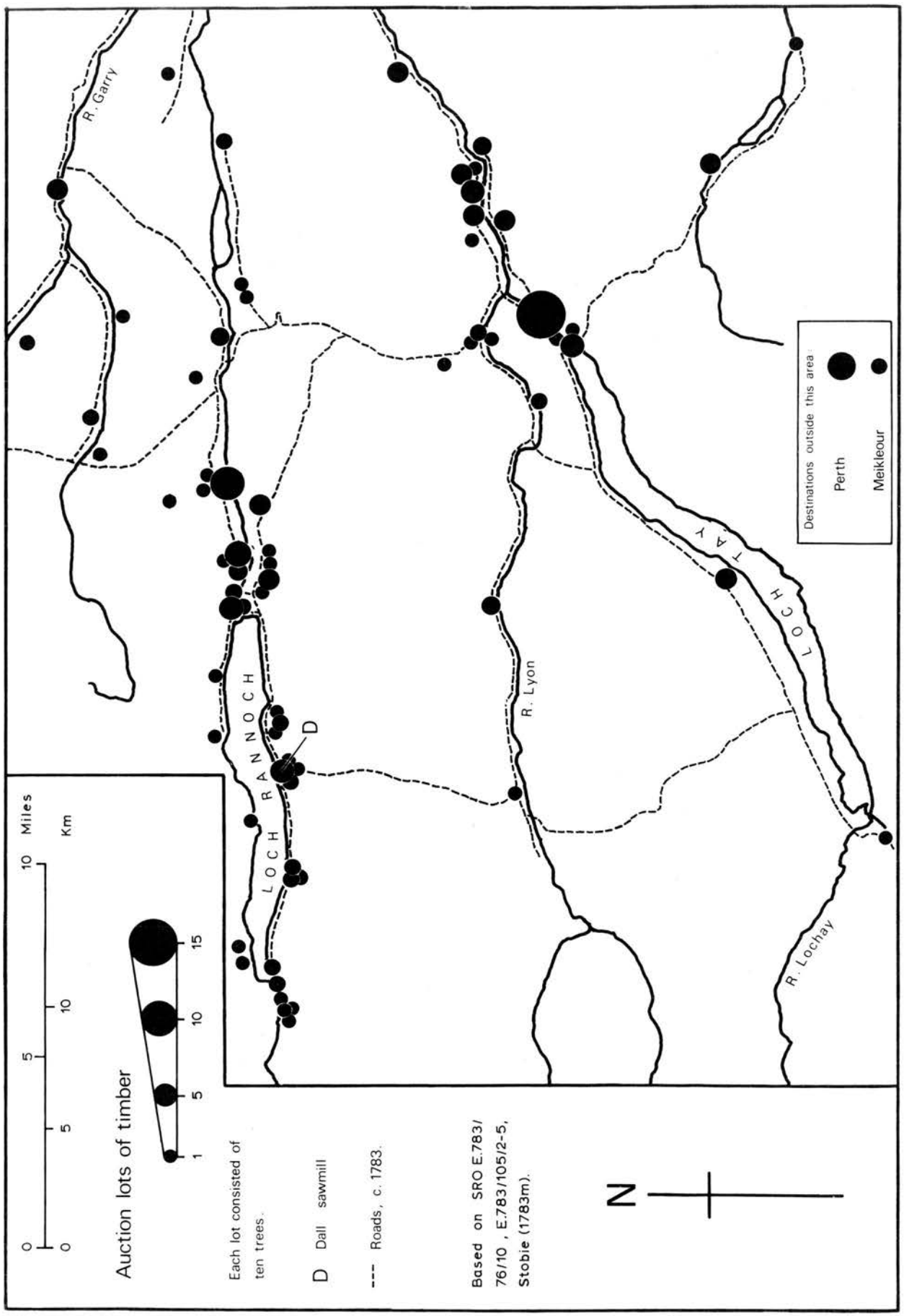


Figure 6.5 The destinations of pine timber sold at Carie, 1779-81.

such a record is available for the last few years, however, in the form of roup rolls. The list of purchasers at the roup of thirty lots in 1779 is unsatisfactory in form, identifying the residence of the purchaser in a minority of cases, but the rolls of 1780, 1781 and 1782 provide a precise record of the destinations of 174 of the 186 lots of ten trees sold. The distribution of the 1,740 trees is indicated by Figure 6.5. In the absence of other evidence it has been necessary to assume that timber was delivered to the purchaser's residence, but this may be incorrect in some cases; the fifteen lots bought by the earl of Breadalbane may have been used at a number of points on his extensive estate and Menzies of Menzies, who bought five lots, possessed lands near Aberfeldy and also on the north shore of Loch Rannoch. A total of twelve lots were bought by three different purchasers to whom precise locations cannot be assigned.

Figure 6.5 indicates that sale was localised; forty-nine per cent of the timber was sold to destinations within ten miles (16 km) of the sawmill and less than six per cent went outside a radius of twenty miles (32 km). Thirty per cent was sold to tenants on Struan estate, of which approximately half was bought by those in Slisgarrow; there were two major concentrations outside the barony. One included the relatively densely populated area between Kinloch Rannoch and the constriction of the Tummel valley at Dunalastair; the other included the lower Lyon and the

Tay valley to a distance of eight miles (12.9 km) below Loch Tay. The second concentration accounted for thirty-three per cent of the timber sold to identifiable destinations, and approximately sixty per cent of the market beyond a ten-mile radius of Dall; distance evidently had a deterrent effect on small consumers, and there were fewer small orders from this area than from those closer to the sawmill (Fig. 6.5). Glen Lyon may have been a more significant market than Figure 6.5 suggests; the figure necessarily excludes ten loads bought by two wrights in partnership at an unspecified point in the glen. As late as 1782, however, the poor state of the road from Dall to Innerwick in Glen Lyon made necessary a detour adding greatly to the length of the journey, and George Nicolson thought that sale to Glen Lyon could be greatly improved (SRO E.788/16/1-2, Fig. 6.5).

Approximately one quarter of the total quantity sold in 1780-2 was bought by proprietors and their factors (27.4 per cent) and a small quantity was bought by ministers and schoolmasters (5.9 per cent). Almost half was bought by men of tenant status (47.9 per cent) and only one fifth was sold to men described in the roup rolls as wrights or timber workers (18.8 per cent) (SRO E.783/105/4-6). Most of the timber was probably therefore used in the construction, repair and furnishing of buildings and for other uses on farm and estate. It may be noted that the proportion of timber bought by tenants decreased as distance

from the sawmill increased; most of the demand beyond a ten-mile (16 km) radius was from proprietors and timber-workers. The wrights performed varied roles. One man in Glen Lyon who bought timber in 1781 had been recommended to the board for training as a ploughwright in 1766 (SRO E.783/48/4). Another living at Lawers on Loch Tay had been employed to repair the sawmill in the early 1770s (SRO E.783/102 (1771), E.783/105/4-5); a third in Kinloch Rannoch, who bought no timber in this period, described himself in 1781 as a cart and square wright (SRO E.721/27, 61).

Proposals previously made for the extension of the sale of timber beyond the neighbourhood do not seem to have attracted serious attention. In 1757 Small and Sandeman suggested that the price of Rannoch timber could be improved by the building of a road to the west coast, which was only eighteen miles (29 km) away (SRO E.783/76/2). The proposed road may have been intended to permit coastal shipping southward from Kinlochleven, twenty miles (32 km) from the west end of the loch. A more practical suggestion was made in 1777 when George Nicolson proposed that one of two local wrights should be established as a timber merchant selling sawn timber to lowland markets with the assistance of the board; the chosen man was to be given land for a yard and credit sufficient to allow him to establish the business (SRO E.783/76/5). Between 1780 and 1782, however, only nine of the 186 lots sold went to

the lowlands and seven of these were in fact bought by the wright from Perth who was acting as auctioneer (SRO E.783/102 (1782), E.783/105/5).

It is apparent that improvement in communications did not make Rannoch timber any more competitive in lowland markets, and the sale of imported timber reduced the importance of Rannoch wood within the established market area. Even in the vicinity of the wood there appears to have been little or no price differential, although local timber was perhaps more convenient for use when wood was required at short notice. The earl of Breadalbane was the principal customer in 1780-2, taking fifteen lots (Fig. 6.5). The tacksman was unable to meet a sudden demand from Breadalbane in 1778 without exceeding his quota, and the earl's agent was able to obtain timber by threatening to buy foreign wood from Perth in the future (SRO E.721/27, 43, E.783/60/220). When timber was sold only at a single annual roup the flexibility of supply was diminished; George Nicolson claimed that in August 1778 he had met men in the district who were compelled to buy foreign timber from Perth rather than wait until the roup at Rannoch in the following month (SRO E.788/22/2).

The market available for Rannoch timber was therefore restricted. There is no evidence of expansion in spatial terms during governmental administration; increased sale

within the accessible market area could be expected only as a result of gradual increase in the number of consumers or growth of consumption per head, without competition from an alternative source. As already noted, more than eighty per cent of the timber was sold directly to consumers for construction, repairs and estate improvement; the predominance of occasional customers rather than professional timber workers with regular demands made it likely that demand would vary greatly from year to year. The form of management employed during governmental control does not appear to have taken account of the difficulties of sale in such conditions.

6.6 Sale of the produce

Robertson of Struan apparently maintained direct control over felling, but immediately before his death in March 1749 he gave a three-year tack of the sawmills and the timber cut in lieu of rent to one Charles Alexander, who abandoned the tack when the barons of exchequer assumed control. Later in 1749 Struan's factor granted a similar tack to Captain Alexander Robertson, although no longer empowered to do so; Robertson continued cutting until served with an interdict in August 1750, and proceedings against him continued until 1757 (SRO E.783/26/1, E.783/26/6, E.783/26/13, 3-12). These tacks were not copied in detail, but in general terms provided a model for those employed in the next thirty years.

Between Whitsunday 1751 and the end of 1778 the wood was let on a series of tacks of three years or occasionally less; in each case the tacksman was given the sawmill and a pendicle adjacent to it. It was recognised that short leases did not encourage the possessor to maintain and improve the woods and sawmill, but the period of tack was not increased; competent tacksmen were instead given preference when the wood was next leased (SRO E.783/60/9(2), E.783/60/17). Thus Alexander McDougal held the tack during ten cutting seasons from 1756 to 1766 (SRO E.721/10, 116, E.783/85/1); he was succeeded by Alexander Cumming, who cut the wood between 1767 and 1778 (SRO E.721/27, 43, E.783/103/15). In the few years between the removal of Cumming and the restoration of the estate to the heir a measured quantity of timber was annually rouped in lots (SRO E.783/105/3-6).

The nature of the tack of 1751 has already been described (above, 6.3). In 1754 Small gave a tack to one Alexander Cameron from Lochaber, on behalf of his cousin Angus in Camghouran (SRO E.783/25/5). Sale proved difficult, apparently because Angus Cameron had become the object of local hostility to Camerons, and the wood was verbally sublet to William Forbes, a local man; when the tack expired £150 of tack duty was still due and in 1777 £40 of the sum remained to be recovered (SRO E.726/2, 15, E.783/60/73, E.783/102 (1757), E.783/105/1). When offers were received for the next tack, the first in

which the quota was stated in tons, Forbes was the highest bidder but was unable to find surety; Alexander McDougal in Drumcharry in Glen Lyon was preferred, paying 15/6d. per ton for timber cut in the old mill and 18/6d.per ton from the new mill (SRO E.783/50/1, E.783/85/1).

McDougal complained in 1758 about the measure used and the state of the wood, and in 1759 he objected to the way the higher charge was introduced when the new mill came into operation; in 1762 he obtained an order for the restoration of tenant services (SRO E.721/6, 164-5, E.783/60/7(1), E.783/60/17). Real difficulty was first evident in the following year, when he asked that the lower limit of his quota should be reduced from 150 to 100 tons; it is evident that the demand for Rannoch timber was declining, but Small recommended that the quota should be reduced only in exceptional circumstances (SRO E.783/60/61(1-2)). The annual minimum remained as 150 tons, and early in 1767 McDougal petitioned again, asking for a new tack with a quota of 150 tons and the option of cutting fifty tons more or less, depending on the state of the market; sale had been dull in the previous two years and he still had 200 tons on hand (SRO E.783/60/155).

Alexander Cumming became tacksman in the 1767 season, on terms similar to those of McDougal's tacks; he was relatively soon faced with the difficulty of maintaining production while the sawmill was repaired. In 1773 he asked the board to compensate him for uncompleted orders

and timber which had decayed unsold, and requested a new tack with a quota of 100 tons and a price of 15/0d. per ton (SRO E.783/60/197). Compensation was paid and the new terms were approved, but it was decided that the tacksmanship was to be rouped (SRO E.721/27, 26). Cumming was evidently highest bidder at the roup, however, and remained at the sawmill until Whitsunday 1778. In 1773 and 1774 he cut quotas of 100 tons, but in the next three seasons the quota fell to 100 trees; an additional quota was obtained by order early in 1778 to meet an unexpected demand from the earl of Breadalbane (SRO E.721/27, 43, E.783/103/21-2, E.783/105/1-2).

When Cumming's tack ended in 1778 the annual cutting had declined to a small quantity, and reports about the mode of sale were submitted to the board. The forester suggested that tacks should be given with a quota of 100 tons; alternatively the sawmiller was to maintain a stock of sawn timber of accepted dimensions for any merchants who should call (SRO E.783/76/6). The factor also proposed that tacks should be given, although each year the quota was to be determined by the board within a range between 100 and 300 tons (SRO. E.783/76/6). George Nicolson favoured a more flexible system in which purchasers were free to order timber when convenient and have it sawn at Dall at fixed rates or take it away for sawing elsewhere; he thought that as many as 1,000 trees could be cut annually (SRO E.783/76/5, E.788/22/2). In 1775 the board had ordered that sufficient timber to meet

local demands should be rouped annually in September; no action had been taken on this order, but in July 1778 it was decided that a roup should be held that year, although reports submitted all proposed other means of sale (SRO E.721/27, 34, 45). Roups were held throughout the remaining period of governmental control.

The decline in production between 1772 and 1780 is indicated by Figure 6.4. Production appears to have recovered with the introduction of annual roups; the large quantity sold in 1780 was entirely timber blown down in the winter of 1778-9, but sale in the following two years remained within the range established before 1772 (SRO E.783/105/4, Fig.6.4). Decline therefore appears to be associated with the previous mode of sale but, as already noted, the factor and forester wished the tack system to continue on a more flexible basis despite the sudden collapse; some explanation may be found in the price and quota levels incorporated.

Under the tack of 1751 the tacksman paid £210 for 1,200 trees; the average payment per tree was therefore 3/6d., which included cutting and delivery by the tenants (SRO E.783/25/2, E.783/26/16). Having complained of the excessive profit allowed by the 1751 tack, Small charged the same duty in 1754 but halved the number of trees, raising the average payment to 7/0d. (SRO E.783/25/5). By his calculations the average value to the tacksman of the good trees cut under the 1751 tack was

between 12/7d. and 13/9d. When inferior trees were used the number of logs was reduced and each yielded a smaller number of poorer deals. In one estimate Small calculated that such trees were worth 9/9d. each, but in another he set the value as low as 7/8d. (SRO E.783/26/11, E.783/26/16). The contract of 1754 was designed to use inferior trees; the minimum calculated surplus after costs therefore fell from 9/1d. per tree in 1751 to 8d. in 1754.

In 1757 George Sandeman considered that 12/0d. was a fair price for a ton of timber cut at the existing sawmill, but higher offers were made; Alexander McDougal agreed as tacksman to pay 15/6d. per ton for timber from the old mill and 18/6d. per ton from the new mill (SRO E.783/50/1, E.783/85/1). As the ton was approximately equal to three trees, McDougal paid 5/2d. and 6/2d. per tree on average, without including cutting and delivery. The smaller trees cut in Rannoch generally yielded two logs and a burden; if delivery of each of these sections cost 4d., as was customary after conversion of services, another shilling would be added to each price, raising them to 6/2d. and 7/2d. respectively (SRO E.783/76/6). The tacksman was therefore in a more favourable position than in 1754 while the old mill was in use, but a genuine increase in quality of produce was necessary if the sale of timber cut at the new mill was to be as profitable.

In 1759 McDougal claimed in a petition that 15/6d. per ton was a high enough price, although he was not un-

willing to pay 18/6d. for timber cut when the new mill was ready; in Small's opinion 18/6d. was the highest price which could be expected and Sandeman thought that it was too high (SRO E.783/60/17). When McDougal asked for a reduction in the quota in 1763, Small acknowledged that the price was high and suggested that the board might reduce the tack duty rather than permit reduction in output (SRO E.783/60/61(1-2)). No change was made, however, and in 1767 McDougal again asked for a smaller quota, observing that the high duty allowed him only a 'scrimp living' (SRO E.783/60/155). The price was in fact reduced in 1773 and remained at 15/0d. until 1778 (SRO E.783/102 (1775)).

Such a price was equivalent to 5/0d. per tree, or 6/0d. with the addition of one shilling for cutting and delivery. It appears that there was in fact a slight decline in the price of Rannoch timber over the period rather than an increase, despite the improvement of the Dall mill. Nicolson took an average value of 4/0d., excluding delivery costs, as the basis for an estimate in 1777, and the average price of trees bought by roup, which excluded cutting and delivery costs, was also relatively low. Standing trees rouped in 1779, 1781 and 1782 were sold for an average of 5/9d., a price lower than that of 1754 even after the addition of a shilling for delivery costs; fallen timber sold in 1780 and 1781 was worth on average only 2/5d. per tree (SRO E.783/76/8,

E.783/105/4-6).

Despite high tack duties the tacksmen were able to survive; both McDougal and Cumming remained as tacksmen as long as the board chose to permit them, and both saw the solution to their problems in the reduction of the annual quota rather than a lower tack duty. This suggests that a certain amount of timber could be sold at high prices, but it is evident that as the period advanced the number of customers willing to pay an inflated price for Rannoch timber declined; as already noted, the demand from Atholl was reduced when access to the woods of Braemar was improved, and competition from foreign timber was seen as a threat to sale in other districts. One reason for the commissioners' reluctance to reduce the quota was suggested by James Small in 1767, when he observed that McDougal passed on the high price of his timber to the customers; Small thought that a tacksman with a smaller quota would be more confident in his ability to dispose of it; he would therefore raise his price and possibly force his customers to buy foreign timber (SRO E.783/60/61(2)). Even if the price remained unchanged reduction of output would in any case make the import of timber more necessary.

The inflexibility of the quota system was demonstrated during the collapse between 1772 and 1779. Small stated in 1763 that the cutting of a smaller amount would be permitted when the sawmill was out of action, but Cumming was not allowed to reduce the level of felling

while the sawmill was intermittently under repair between 1769 and 1772; he consequently cut no more than enough to fulfil his obligation under the lease, as is indicated by Figure 6.4, but was unable to sell all of it while it was still fit for use (SRO E.783/60/61(2), E.783/60/197, Fig. 6.4). In 1773 the quota was reduced to 100 tons and in 1775 Cumming succeeded in having it lowered to 100 trees, equivalent to 33 tons. The quantity of timber annually available was therefore reduced to little more than twenty per cent of the accepted minimal level over the space of four years.

The nature of the quota system did not allow the tacksman to adjust to short-term fluctuations in the market. The failure of the system in the long term, however, may be attributed to the high tack duty demanded. The market appears to have been invaded by imported timber, perhaps aided by reductions in overland carriage costs; the high price of Rannoch wood probably encouraged some customers to buy foreign timber and a tacksman obliged to pay for more timber than he could easily sell was not in a position to offer competitive prices to his remaining customers. The decreased reliability of the supply from Rannoch may have contributed to the collapse after 1772; the intermittent working of the period 1769-72 may have discouraged some intending purchasers and the reduction of the quota would make it less likely that demand would be satisfied. George Nicolson may have shared the exper-

ience of some prospective purchasers when he visited the mill in two successive seasons and found no timber available for sale; Cumming had a second livelihood which reduced his interest in the woods to some extent (SRO E. 783/76/5). When regular advertised roups were introduced the annual sale of timber returned rapidly to that obtaining before 1772 (Fig. 6.4).

The reluctance of the board to permit reduction of a tack duty which they knew to be high is not entirely explicable; the maintenance of a high tack duty was perhaps thought necessary to recoup outlay on the wood. The annual income available to the estate from the sale of timber between 1750 and 1782 is shown by Figure 6.4; this income consisted basically of the tack duty paid for the woods and sawmill, after deduction of the value of timber granted for non-commercial uses and the sums repaid to the tacksmen under the early contracts in relation to tenant services. Between 1754 and 1782 there was generally a close relationship between the quantity of timber felled and the level of income; minor irregularities resulted from the non-commercial use of timber in some years, and the relationship was altered in 1780 and 1781 by the sale of a large amount of fallen timber at low prices. The major discrepancy arose between 1751 and 1753, when the tacksmen were allowed to cut large quantities but paid only a small tack duty (Fig. 6.4). The total income from woods over the whole period was approximately £4,208,

indicating an average annual income of £127.10.0d. to the estate in each of the thirty-three years; the average was approximately £154 in the first twenty-three years but fell to £67 in the ten years after 1773.

The commissioners spent a considerable amount on the maintenance of the wood. Wages accounted for part of this expenditure; a sawmiller was employed after 1759 at an annual salary of £8, and after 1768 the employment of a measurer raised the direct annual cost of wages to £23 (SRO E.721/4, 225, E.783/76/4). This suggests a total wage bill of £394 between 1759 and 1782. Construction of the sawmill at Dall cost more than £350, and repairs to the mill in the period 1768-79 alone cost an additional £242 (SRO E.721/4, 207-8, E.783/76/4). The commissioners paid almost £300 for enclosure, although only £180 of this was paid before the end of 1782 (SRO E.783/102 (1782)). In total these outlays, which are most unlikely to represent the entire amount spent on the wood during governmental administration, amount to £1,166.

When such costs are deducted the income from woods during the period is reduced to £3,042, indicating that the estate received an average income of slightly more than £91 after deductions; rather more than seventy per cent of the average annual income of £127. 10. 0d. was therefore retained. As is suggested by Figure 6.4, however, the income of the estate both before and after deductions would have been considerably larger if the tacksmen had

been able annually to cut and pay for the full quota allowed by the contracts of the period between 1757 and 1772. It may be suggested that a higher income could have been maintained without damage to the wood if management had been adapted more effectively to the conditions in which the timber of Rannoch was sold. Sales improved markedly after timber was first rouped in 1779, and in 1782 the factor reported that it was the best mode of sale ever known in Rannoch (Fig. 6.4, SRO E.788/16/2). Two years later, however, the wood was restored to private hands.

6.7 Effects on the quantity and quality of woodland

John Lesslie surveyed the estate of Struan during fifteen weeks in 1756 by order of the annexed estate commissioners (SRO E.783/47/1-3). Twenty years later James Stobie began work on his map of Perthshire; the initial proposal was made at the end of 1775 and the map was published in 1783 (SRO E.783/54/1(2)). The two surveys therefore provide independent records of the state of the wood of Rannoch at the beginning of governmental control and immediately before the end. Figure 6.6 is based on Lesslie's general plan of 1756; the plan is accompanied by a detailed descriptive account and is therefore employed here instead of the appropriate sheets of the Military Survey, which also seem to be considerably less accurate (SRO E.783/98, RHP.3480, M.S. (1747-55m) 15/1, 16/5).

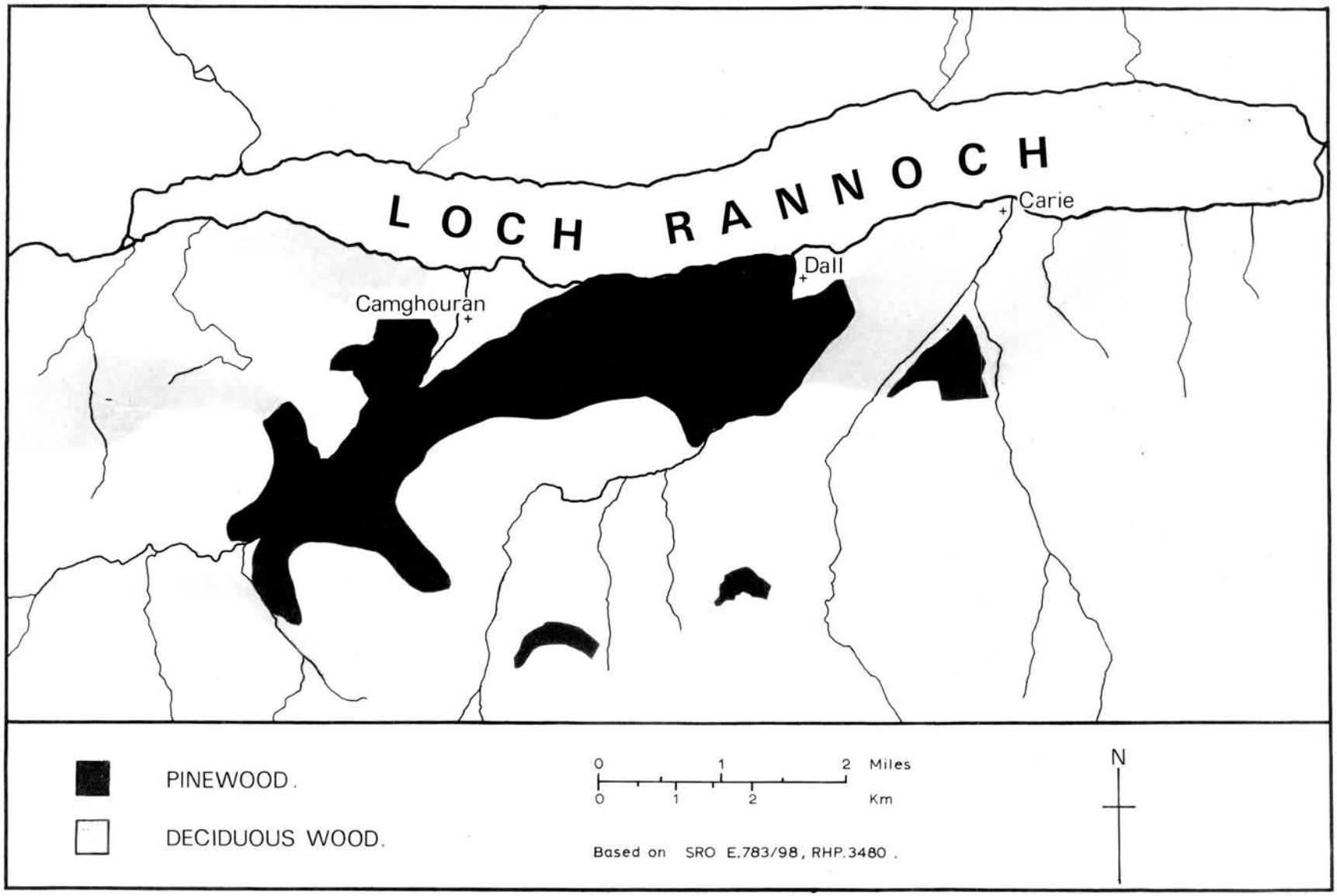


Figure 6.6 . The Wood of Rannoch, 1756 .

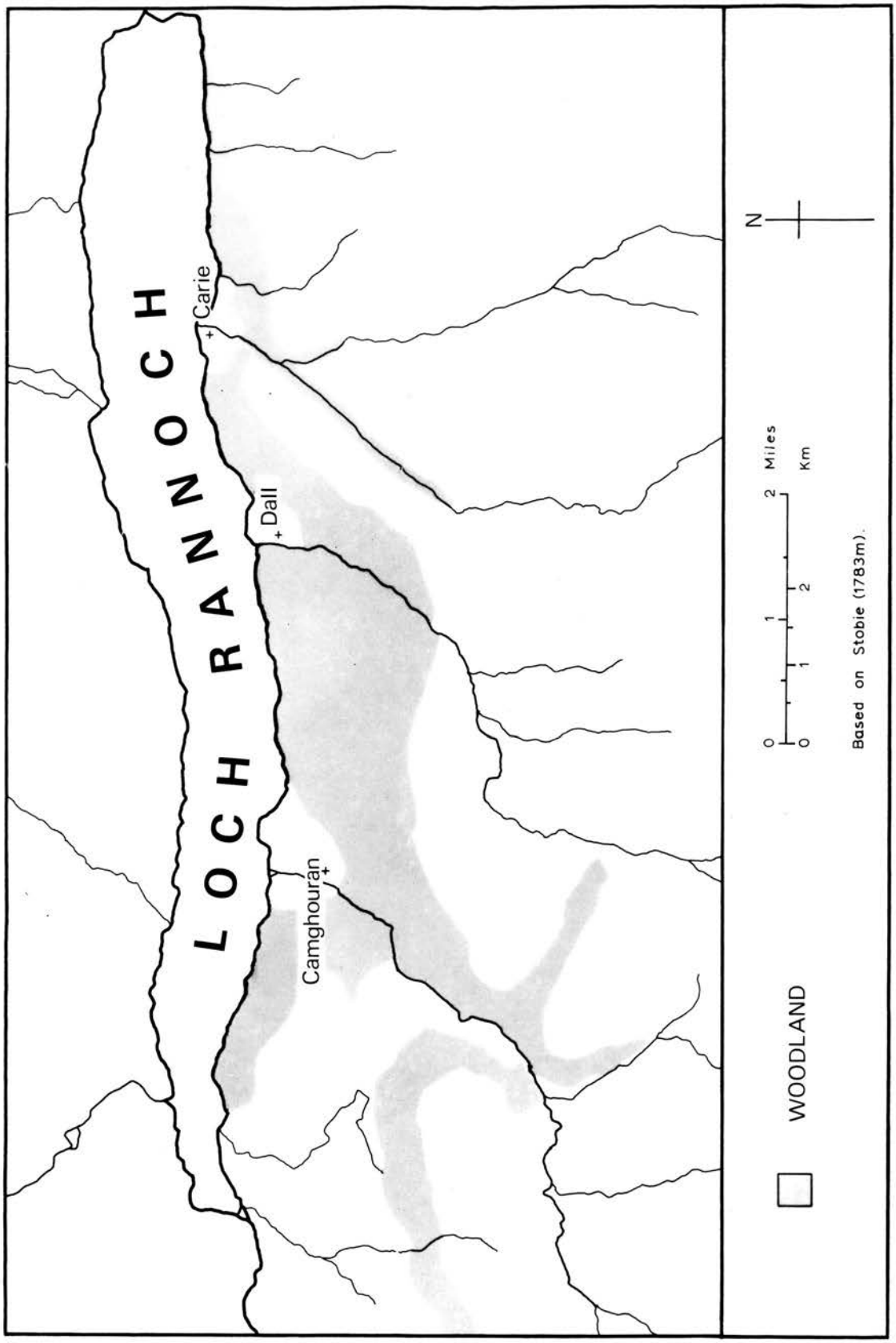


Figure 6.7 . The Wood of Rannoch , 1783 .

It is evident that the pinewood occupied the central part of a belt of woodland which extended from the east end of the loch to the margin of Rannoch Moor on the west. Deciduous wood pre-dominated east of Dall and west of Camghouran but pinewood extended for some distance up the Allt Camghouran; there were two small outliers south of the main body of the wood (Fig. 6.6).

Stobie's survey indicates a very similar pattern, and relatively little change in the area of pinewood as defined by Lesslie; the absence of small birch and pine woods marked by Lesslie south of the main wood may result from the smaller scale and generalised nature of Stobie's map rather than the physical disappearance of these woods. The area of deciduous woodland at the west end of the wood may have decreased slightly, but there was a very marked reduction in the area of birchwood at the east end. A pinewood of approximately 200 acres (81 ha) south of Carie was also absent from the later survey, but it may be noted that Lesslie, although including it in a list of pinewoods in the text, did not depict it as such on the plan (SRO E. 783/98, 28, RHP.3480, Fig.6.7). Comparison of the two surveys gives no reason to believe that the pinewood declined significantly in area during governmental control; the decline of deciduous woodland may be associated with Small's interest in extirpating birch and alder (above, 6.4).

According to Lesslie's measurements the estate of Struan included 7,933 acres (3,213 ha) of woodland, of

which 7,537 acres (3,051 ha) were in Slisgarrow; pinewood covered 3,066 acres (1,242 ha) and the remaining 4,471 acres (1,810 ha) were largely birchwood. The Black Wood contained only the central section of pinewood between Allt Camghouran and the Dall Burn, and covered 1,885 acres (763 ha); the remaining 1,181 acres (478 ha) of pinewood were divided into six outlying sections of varying sizes (SRO E.783/98, 24, 28, 31, 57). Another survey appears to have been carried out soon after the return of the estate to the Robertsons; at some time before 1799 James Robertson was told by the laird of Struan that the pinewood covered 2,566 acres (1,039 ha) and that an additional 3,869 acres (1,567 ha) were occupied by detached woods of oak, birch and alder (Robertson (1799) 235-6). This suggests a reduction of fourteen per cent in the area of woodland since 1756, shared approximately equally by the pine and deciduous wood.

Felling has since then been relatively limited and irregular. Another attempt was made to sell the produce outside the district at the beginning of the nineteenth century. Part of the wood was advertised for sale in 1798 and said to contain at least 400,000 mature pines; it was claimed that although the timber had previously been consumed locally it could be floated cheaply to Perth for national distribution. According to Hunter, the wood was purchased by a southern company which was soon defeated by the cost of bringing timber to the loch shore

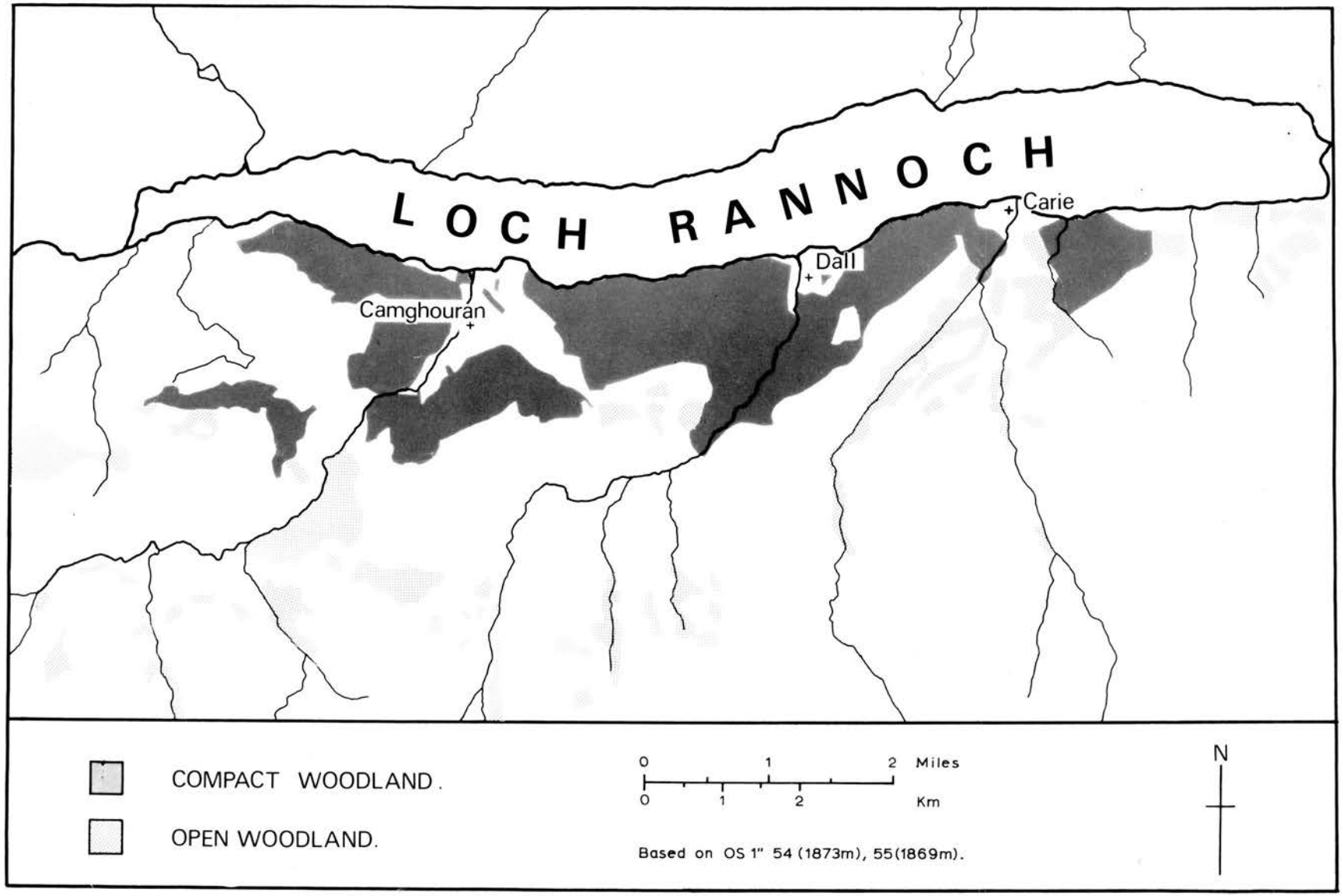


Figure 6.8 . The Wood of Rannoch , c.1870

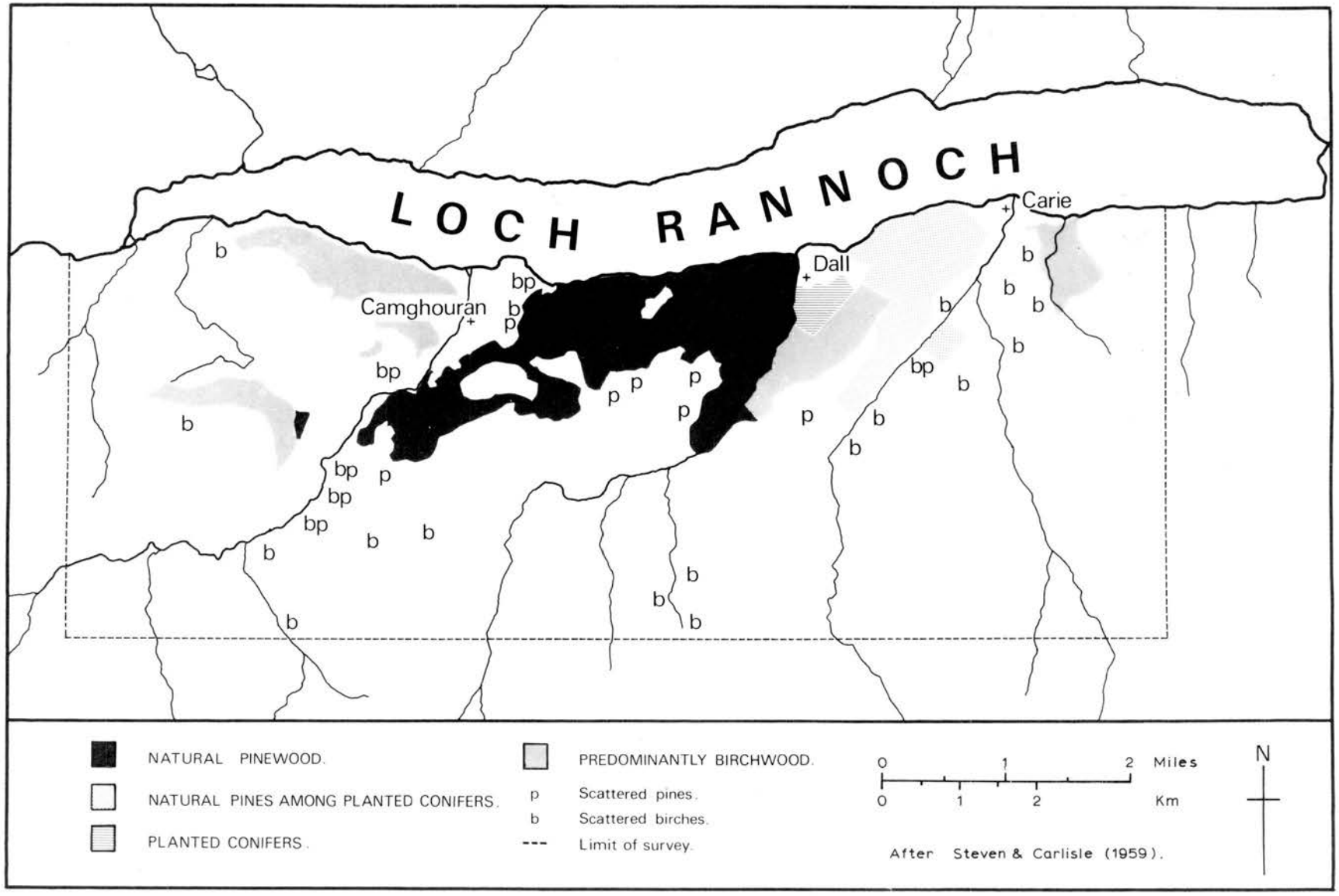


Figure 6.9 . The Wood of Rannoch , 1959 .

and transporting it out of the Highlands. In 1804 the wood was again advertised, for cutting over an indefinite period on terms resembling those previously employed; offers were to include a proposed annual quota and a price per ton (Hunter (1883) 412-3), Anderson (1967) V.2, 61). No evidence is available concerning response to this advertisement, and little information is available about felling until the end of the nineteenth century, when a certain quantity was cut for sleepers for the railway across Rannoch Moor. The wood escaped felling during the first world war; light felling for estate use was undertaken between the wars and only 8,000 trees were cut between 1939 and 1945 (Whayman (1953) 112-17).

The district was first mapped by the Ordnance Survey about 1870, and the pattern of woodland at that time is illustrated by Figure 6.8. The distinction between compact and open woodland, not made in the previous surveys, emphasises the importance of the central body of wood, but also indicates the survival of scattered trees on a large number of sites. The distribution of woodland was comparable to that shown by Stobie but the continuity of cover was greatly reduced; this may in part be related to the greater precision of the later survey. The northern part of the area identified by Lesslie as pinewood was little changed, although the clearing around Camghouran had been extended, but the marginal southern sections surviving in 1783 had disappeared or been reduced to pine heath. The

areas identified by Lesslie as birchwood had suffered comparable fates since that date, although deterioration was now more marked on the western margin than in the east (Fig.6.8).

Figure 6.9, based on the survey made by Steven and Carlisle in 1959, indicates the recent extent and species composition of the wood. The area of compact woodland has changed slightly since 1870, although there have been reductions immediately west of Camghouran and east of Carie. The Black Wood still covers almost 1,500 acres (607 ha) and coniferous plantations occupy much of the area between Dall and Carie; in view of the apparent previous absence of pine from the sites involved, the identification by Steven and Carlisle of areas of plantation incorporating some semi-natural pines may be questioned. There has been a considerable change in species composition since Lesslie's survey. Only one small area of compact natural pinewood survives outside the Black Wood, and there appears to have been a transition from pinewood to birchwood in other cases. Thus the woods immediately south of Dall and west of Camghouran depicted by Lesslie as pinewoods are now dominated by birch, which also predominates among the scattered trees on sites formerly occupied by pinewood (Fig.6.6, Fig.6.9).

Birch occurs at present in the pinewood of Rannoch, and it has already been noted that such a mixture existed in the eighteenth century (above, 6.4). Transition from

pinewood to birchwood might therefore be explained as a result of selective felling, and it is possible that the birchwood which predominated at the east end of the wood in 1756 occupied the site of a former pinewood over-exploited because of proximity to the sawmills. The northern part of the Black Wood, the section likely to have been subject to the heaviest and most sustained felling, survives as the present Black Wood of Rannoch; after a long period of felling the central part of the Black Wood remained dominated by pine. Some of the more recent changes of dominance have taken place in the inland part of the west end of the wood, and the most complete disappearance of stands of pine has been from the same inland and upland sections, which are least likely to have been subject to regular and intensive felling.

The survival of the present Black Wood appears to result in part from regeneration in the few decades after enclosure; trees in the appropriate age group are common in the wood (Steven & Carlisle (1959) 142-3). Some may have been planted in accordance with the board's orders, but natural regeneration was recorded at least as late as 1782 (SRO E.788/16/1). If the more remote stands were as healthy as the sections enclosed it might be expected that trees mature at the time of enclosure would have survived on the more remote unenclosed sites even if regeneration did not occur; the openness of these stands as early as 1870 suggests that the outlying sections were

moribund in the late eighteenth century. It has already been observed that the upper margin of the present pinewood is at an altitude of 1,100 feet (334 m) (above, 6.1); the inland stands were almost entirely at higher altitudes, and the slightly less favourable climatic conditions may have made them more vulnerable to regenerative failure under increased grazing pressure. Both at Ball and Camghouran, however, the pine of areas at lower altitudes outside the enclosure has been replaced by birch since 1756; both areas of woodland are close to settlements and pine may have declined under the combined pressure of felling and intensive winter grazing (Fig.6.6, Fig.6.9).

It may therefore be suggested that the deterioration of the marginal sections of the pinewood has resulted from grazing damage, aggravated in some sections by climatic marginality and in others by felling for local and commercial purposes. There has been a tendency for birch to replace pine, and the apparent decline of pinewood between Lesslie's and Robertson's surveys may have been due to changes in dominance in the marginal stands. On the other hand, there has also been a marked decline in the extent of deciduous woodland; as this decline continued after 1800 it cannot be attributed entirely to Small's clearance of birch and alder. It is also unlikely to have resulted from systematic commercial felling, and domestic use by the small population of the immediate vicinity is not likely in itself to have had severe effects. Extensive

sheep farming was established in the area before 1790, however, and grazing pressure, especially after casual cutting, may have been severe enough to reduce birch woodland to non-regenerative scrub and eventually destroy it (OSAS V.2 (1791) 454). Pressure of such intensity would also have serious effects on the regeneration of pine.

Regeneration has been poor in the Black Wood since 1830, and the present wood survives largely because felling since then has been limited. After examination of the Wood of Rannoch and other fragments of pinewood around Rannoch Moor Malcolm suggested that this was the result of a general process of site degradation, associated with the mound-and-hollow topography typical of the Rannoch site. He considered that on such sites the opening of the canopy reduced the transpiration rate and allowed the water table to rise; the hollows consequently became marshy and unsuitable for pine regeneration. Continued opening of the stand led to increased waterlogging and peat formation, asphyxiating trees on the lower slopes of the mounds and eventually reducing the stand to a few scattered pines on the drier parts of the mound, without regeneration. Removal of birch and alder, which have higher transpiration rates, would intensify the process (Malcolm (1957) 16, 29).

Malcolm attributed the process largely to anthropogenic factors, and considered that felling and grazing

were principally responsible. Selective felling allowed the initial opening of the canopy, and the process was accelerated after clear-felling; removal of deciduous species intensified the process and deprived the pinewood of the beneficial effects of birch on the biological activity of the litter. Grazing accelerated degradation by destroying regenerative growth, and selective grazing, especially by sheep, favoured the survival of plants like heather which intensify the process of degradation. Malcolm also thought that degradation of this type was a continuing process, and found that it was most marked on the margins of the stands while the centre remained relatively healthy (Malcolm)(1957) 16, 29, 38).

The continued health of the centre of the wood suggests that severe degradation may be a relatively recent process. Pollen from the peat of hollows in Rannoch has been analysed by Hayes but no absolute chronology was established, although it is evident that pine and birch were the principal components before and after the onset of degradation and peat formation (Hayes (1967) 160-1). If felling were a principal factor, it might be expected that the centre of the stand, where the trees would be better for commercial use than the spreading short specimens of the more open sections of the pinewood, would be similarly affected; it is evident too that the scale of felling has been limited since the end of the eighteenth

century. If grazing were the major cause, however, it would be more probable that degradation would start on the open margins of the pine stands, where higher light intensity would permit a density of ground vegetation higher than in the centre of the stand.

As already noted, regeneration was possible in the Wood of Rannoch before it was enclosed, although protection of the young trees was thought desirable (above, 6.4). Pennant observed that roe deer were common in the wood, but those who managed the wood considered that domesticated animals were the main source of danger (Pennant (1771) 87-8). Thus Robert Menzies proposed in 1781 that an adequate fence should be erected round the upper margin of the pinewood not to exclude deer but to protect the wood from unhoused farm stock in winter (SRO E.783/76/11). Regeneration evidently continued after enclosure and the end of reliable regeneration may be associated with the opening of the enclosure to farm stock in the nineteenth century; by that time extensive sheep farming was well established locally and it has already been suggested that the decline of unprotected woodland in the vicinity of the pinewood resulted from grazing by sheep. The wood was enclosed as deer forest later in the century, but after 1918 was again opened for general grazing (Whayman (1953) 117). Roe deer remain in the eastern half of the wood, but it has been protected against domesticated animals since 1947, and this appears to have allowed some

improvement in regeneration (Goodlet (1973) 43).

Fire appears to have had a limited role in regeneration in this instance. Minor forest fires were recorded in the wood while it was under governmental control but there is no evidence that they led to improved regeneration (SRO E.783/60/210); there does not appear to have been a major fire in the wood since then. It has already been noted that mass regeneration after fire may not be characteristic of the open western pinewoods, and regeneration in Rannoch may generally have followed small localised fires or other ground disturbances (above, 5.3). It cannot be certain whether or not the wood was capable of replacing losses fully without assistance in the eighteenth century; the level of replacement may have been sufficient only to permit a gradual decline in extent associated with slow degradation due to grazing, repeated burning, and felling. It has already been observed that such a decline seems to have characterised other pinewoods in Perthshire and Argyllshire (above, 5.7).

As has been suggested, the marked decline in the rate of replacement in the middle of the nineteenth century may be associated with the opening of the wood to grazing by sheep and damage by muirburn; Malcolm found evidence of the destruction of mature trees by muirburn, especially on the margins of the wood, and considered that repeated burning accelerated the process of degradation (Malcolm (1957) 32). It has been noted that climatic conditions

in the Highlands probably became more oceanic in the middle of the nineteenth century (above, 2.3); increased precipitation would intensify a degradation process in which the level of the water table was a critical factor, and effects on the more exposed and higher parts may have been especially severe (Malcolm (1957) 25). It is possible that the combined effects of these climatic and anthropogenic factors accelerated an established process of degradation sufficiently to have a marked effect on regeneration.

During the period of governmental administration the wood was undoubtedly managed rather than exploited, and genuine efforts were made both to control the rate of extraction and to ensure that losses were replaced. These measures appear to have been successful to the extent that there was little evident decline in the area of the pinewood during the period of administration and the last major phase of regeneration in Rannoch followed the enclosure of the wood in 1781. The form of management employed cannot therefore be said to have been a major factor in the decline of the wood itself and regenerative potential. Indirectly, however, the methods in use during this period may have contributed to the later decline of regeneration.

Selective felling of the best trees was not entirely eliminated and the seed stock may therefore have continued to deteriorate. The policy of clearing deciduous timber did not remove birch and alder entirely but may have had

sufficient impact to emphasise an existing tendency towards site degradation, and also to reduce the quality of litter by creating purer stands of pine. This was the final stage of a period of felling which may have originated as early as the fifteenth century; there is no evidence that the wood was much larger earlier in the historic period than in 1756, and decline was evidently slow. Since the termination of regular felling, however, regeneration has been limited and unpredictable; degradation probably originated while cutting continued but appears to have become significant only since the establishment of extensive sheep farming in the district.

6.8 Summary

The pinewood of Rannoch is the largest in Perthshire or Argyllshire; it belongs to the western group of pinewoods with a strong birch component. Regeneration appears to have been limited since about 1830.

Rannoch timber was commercially used relatively early and regular selective felling was practised by the late seventeenth century; between 1749 and 1784 the wood was managed as part of a forfeited estate by governmentally-appointed bodies.

After initial difficulties a low annual cutting rate was maintained through this period. Selective felling continued to be employed but some concessions were made

towards silvicultural rather than commercial demands. Attempts were made to assist natural regeneration and a certain amount of planting was also probably carried out. Timber was sold almost entirely within a twenty-mile (32 km) radius of the sawmill; an inflexible management policy hampered sale of the produce, especially between 1772 and 1779.

Cartographic evidence shows a limited decline in the area of the pinewood since 1756; some marginal sections have disappeared and others are now dominated by birch. Regeneration appears to have been stopped by acceleration of site degradation, probably as the result of increased sheep grazing in the first half of the nineteenth century associated with muirburn and perhaps minor climatic change. Management during governmental control may have contributed indirectly to this decline by encouraging the removal of deciduous timber and permitting the continued selective felling of pine.